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## Original Articles.

### A STUDENT FORM OF RESPIRATION APPARATUS.*


BY FRANCIS G. BENEDICT, BOSTON,

AND

CORNELIA GOLAY BENEDICT, BOSTON.

[From the Nutrition Laboratory of the Carnegie Institution of Washington, Boston, Mass.]


MEDICAL pedagogy may no longer disregard the subject of metabolism, specifically human gaseous metabolism. In the past few years an increasing correspondence between clinicians and the Nutrition Laboratory has led to two obvious deductions: first, that there is, in the United States at least, a greatly increased interest in gaseous metabolism; and second, from the nature of the correspondence the need for intelligent instruction in the fundamentals of gaseous metabolism and energy relationships is strikingly evident. But however vague, however indicative of almost startling lack of information these letters often are, the one strong, underlying fact is that medical men are making most creditable and strenuous efforts to supply the training in metabolism missing in their medical school courses.

The activities of the Nutrition Laboratory lie outside of the field of the class room and the student laboratory, and our experience is slight in the practical side of the introduction of physiological laboratory methods, but an analysis of catalogued courses in a number of the prominent medical schools shows generally a disregard of actual practice in human metabolism measurements, a disregard that can only be explained by the inherent difficulties existing in all present techniques, which, either by reason of expensive apparatus or elaborate procedures, preclude general laboratory introduction. This is greatly to be deplored, for there are now in the market numerous forms of respiration apparatus, and each of them, including the worst form, is capable of measuring the oxygen consumption of a human with an accuracy greater than the most skillful clinician can interpret the results. That being the case, it is certainly a misfortune that the regular medical courses cannot provide means for experience with the sound and well-tested methods of gaseous metabolism.

Two fundamental methods for gaseous metabolism measurements are possible for general

*The apparatus was first demonstrated before the Research Club of the Harvard University Medical School at a public meeting, on February 18, 1921.

laboratory usage: (*a*) the determination of the oxygen absorbed out of a closed, circulating volume of oxygen-rich air, and (*b*) the separation of the inspired and expired air by valves, the collection of the expired air in a bag, dry gas meter or gasometer, and finally the analysis of samples of this air. Both methods involve as a general thing rather expensive apparatus. The first is represented by apparatus selling for several hundred dollars. They are necessarily not as ruggedly designed as most laboratory apparatus for general use have to be, and consequently are liable to damage in general class usage. The second requires either a gas bag, calibrated gas meter, or more commonly a gasometer, which with respiratory valves permit the collection of samples of expired air. Unfortunately these must in turn be analyzed. While an inexpensive gasometer[1] has been described, generally the gasometers employed by those using gaseous metabolism measurements are fully as expensive as the closed-circuit apparatus, and withal gas analysis apparatus, to be of real satisfaction, must be well graduated and calibrated, thus involving increased expense. But the great drawback from the pedagogical standpoint is the length of time required on the part of the student of gas analysis to clean and assemble apparatus, provide the reagents, test, and above all, acquire the dexterity to make a good gas analysis.

*It is especially unfortunate that the medical student who spends the time to acquire gas analysis technique will rarely, if ever, use it subsequently in his private practice.* To be sure, this may be said of many laboratory operations, but, since many of the gaseous metabolism procedures introduced into general practice involve, for the most part, the use of those types of apparatus relying upon the measurement of the oxygen disappearing from a closed volume of oxygen-rich air, and *not* gas analysis, it is particularly unfortunate that the fundamental principle of this first method has as yet not been accessible to the medical student.

The class room uses of the measurements of gaseous metabolism are twofold: first, they impart a knowledge of the composition of the outdoor air and the expired air, the volume of respiration per unit of time, the calculation of the amount of oxygen consumed and carbon dioxide produced per unit of time, and the relation between the volumes of carbon dioxide and oxygen, *i.e.*, the respiratory quotient, which is of great significance as an index of the material being burned in the body. The second important use of these measurements is the possibility of computing therefrom the total metabolism. Pedagogically all the factors above mentioned are of great significance. But practically in clinical use but one plays a great rôle, *i.e.*, the oxygen consumption, for, as stated above, from this is computed the heat production which under known conditions, such as complete muscular repose and in the post-absorptive state, is characterized as the basal metabolism. A knowledge of the basal metabolism has been found of the greatest practical value not only in the study of the disturbances of the ductless glands but also as an index of general tone.

Ideally, any technique that would at one and the same time allow the student to measure and utilize all the factors above mentioned is greatly to be desired. In the special respiration laboratories and probably in hospital laboratories these methods in greatest refinement should be available. In the physiological laboratory such methods are equally desirable, but as yet unavailable. An accurate measurement of the volume of expired air is fairly simple, but a knowledge of the composition of both the inspired and expired air and the calculation of the amount of carbon dioxide produced and oxygen consumed and especially the respiratory quotient are possible only by gas analysis and indeed accurate gas analysis.

Accurate gas analyses require good glass blowing and good workmanship in the graduation of burettes. But given such an improved apparatus, the student has a problem of considerable magnitude to master sufficient of the technique to give him an intelligent picture of the processes of gaseous metabolism. With available time this is, of course, possible. After the technique is acquired and its educational value has been appreciated, its acquisition ceases to be of permanent value.

If a simple, accurate method for the measurement of the oxygen consumption alone could be placed in a student's hands, and particularly if the method embodies the basic principles underlying a class of apparatus now being widely distributed for general clinical use, the student could carry with him directly from the laboratory to his office a technique not impossible of continued service.

Our endeavor to simplify the method of measuring the oxygen consumption from a definite volume of oxygen-rich air has resulted in the development of the apparatus here presented, which in its final form we trust has been reduced to simplest terms without any sacrifices of accuracy for the facility of operation.

The medical student, observing on one of the modern forms of apparatus for measurement of oxygen consumption, certainly can visualize the abstraction of oxygen much more clearly than he can the more subtle process of the determination of carbon-dioxide increment and oxygen deficit, with their relationships in expired air. To see the level of a spirometer bell or the distention of a rubber bag regularly and continuously fall as oxygen is consumed is an act of pedagogical importance not easily overemphasized.

Thus both by inheritance from the gradual

simplification of the essential features of the original universal respiration apparatus[2] and also by virtue of its wholly superior pedagogic value in conveying to the student the quantitative abstraction of oxygen by the lungs, we have naturally based the student form of respiration apparatus upon the closed-circuit principle.

The apparatus consists of three parts: first, the reagent can with its flexible rubber top; second, the valves and mouthpiece; third, the pump to supply quantitatively oxygen or air to the apparatus. In principle the subject, with an ordinary form of mouthpiece, breathes air from the can through one valve and the expired air reënters the can and, passing through the soda-lime in the bottom of the can, is deprived of its carbon dioxide and is rebreathed. A flexible rubber bathing cap allows large changes in volume with each respiration, as well as a gradual decrease in volume due to the absorption of oxygen by the lungs of the subject. The amount thus disappearing in a unit of time is the measure desired. If at the start there is ordinary air in the can and the distended bathing cap, the absorption of oxygen would be so rapid that a normal adult would, in a few minutes, reduce the oxygen percentage to a point where the subject would actually exhibit signs of "oxygen want." If an arrangement can be made to introduce pure oxygen as rapidly as the gas disappears from the can so that the level of the bathing cap distention at the end of each expiration remains about the same, obviously the subject will be breathing air of nearly normal composition throughout the entire test. Such introduction of oxygen is by no means difficult. It has been proved conclusively, however, that there is no measurable difference in oxygen consumption, whether the subject is breathing ordinary air or air enriched with from 80 to 90 per cent. of oxygen. This fact makes the technique for measuring the oxygen consumption very simple, for the air in the can and rubber bathing cap can be enriched with pure oxygen prior to an experiment and *the amount of oxygen absorbed out of the confined volume of oxygen-enriched air determined by introducing with a simple air pump a measured amount of ordinary room air.*

The details of construction are given in Figure 1.

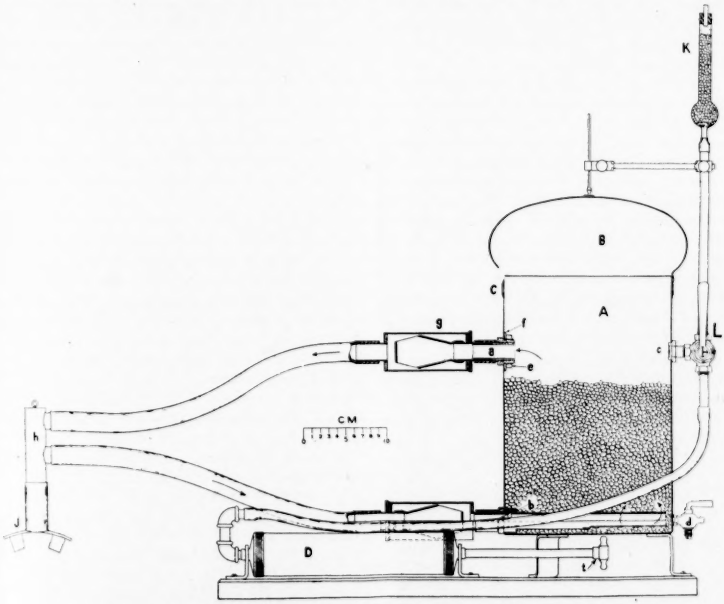


FIG. 1.—A STUDENT FORM OF RESPIRATION APPARATUS.

*A*, metal can partly filled with soda-lime; *B*, rubber bathing cap, held in place by rubber band, *C*. The subject breathes through the mouthpiece, *j*, which is attached to the metallic piece, *h*, connecting with two rubber tubes leading to Sadd respiratory valves on the can, *A*. The expired air enters through the opening, *b*, and is returned to the subject, freed of carbon dioxide, through the opening, *a*. The Sadd valves are enclosed in light brass housings, *g*. The opening, *a*, is stiffened by a lock nut, *e*, and a small, flat piece of iron, *f*, curved to fit the can. Oxygen for preliminary enrichment is admitted through the petcock, *d*, and measured amounts of dry air, drawn through the calcium-chloride tube, *K*, into the pump, *D*, are forced into the can through the valve, *i*, and the opening, *c*.

*The reagent can, A,* of copper or even galvanized iron or tin, is 12 inches high and 8 inches inside diameter. A pure gum bathing cap. *B,* is stretched over the top and held firmly in place by an ordinary rubber office band, *C,* 5 inches by ¾ inch.

There are four openings in the wall of the can. In two, *a* and *b,* are soldered standard "¾ inch to ½ inch" brass bushings.* The hexagonal head of the bushing gives a good firm surface for stiff soldering. In the third opening, *c,* a standard "⅜-inch to ¼-inch" brass bushing is soldered, while in the fourth, *d,* is soldered a standard "¼-inch to ⅛-inch" brass bushing. A ⅛-inch petcock, used to admit oxygen for the preliminary enrichment, is screwed into the bushing, *d.* A 3-way, standard, ¼-inch plug cock is screwed by means of a ¼-inch nipple into the bushing, *c.* This valve serves to admit a measured amount of air.

In the two larger bushings are screwed the air pipes. In *a* is screwed a short piece of standard ½ inch brass pipe. To stiffen the opening a lock nut, *e,* preferably with a small piece of flat iron, *f,* curved to fit the can and with a hole in it, should be screwed onto the outer threading of the bushing inside the can. All sharp edges on the inside of *a* and *c* should be carefully smoothed in order not to cut the thin rubber of the bathing cap. The lower bushing, *b,* has a duplicate piece screwed from the outside, as in *a,* but on the inside is screwed a piece of pipe with a slot ½ inch wide cut for one-half of its length along the bottom.

As the can is seamed along the side, and the bathing cap and the rubber band must make an absolutely tight closure, the upper portion of the seam must be filled in with solder to make a smooth surface for the bag to fit over, and avoid the ridge of the seam with the chance for a leak.

### BATHING CAP.

As a simple expansion chamber nothing more satisfactory than a plain, flat, pure-gum bathing cap has been found. This is manufactured in two sizes.† The size commonly used in the respiration apparatus measures, when flat, 9½ x 10½ inches, with the opening 2¾ x 4 inches. This opening readily stretches over the 8-inch opening of the can and the seal is made doubly sure by means of a rubber band 5 inches by ¾ inch. To aid in noting the exact height of the bathing cap or point of distention of the bag a collar button is attached to the center of the cap by a bit of wax or a drop of glue or shellac.

*These minor parts are all "standard" brass pipe fittings, but the sizes do not represent actual dimensions. Thus, a so-called "½ inch" pipe has an actual internal diameter of 0.623 inch.

†Furnished by the Davol Rubber Company, Providence, R. I. A somewhat larger cap is likewise furnished by this company, measuring 10¼ x 11½ inches, and the opening 3½ x 4¾ inches. This may be used in case a larger cap is desired, but is not used by us. These caps cost about 50 cents each.

### THREE-WAY VALVE FOR ADMITTANCE OF AIR.

The exact volume of air corresponding to the volume of oxygen absorbed is admitted from time to time through a 3-way valve which is attached by means of a close nipple with a standard ¼-inch bushing soldered to the can for rigidity. This is a 3-way valve, standard ¼-inch size, modified only in that a small pin is placed upon the plug and two upon the body of the valve so that, in turning, the plug will come to a stop in a quarter turn. The upper outlet of the valve holds an upright of ⅛-inch brass pipe screwed into a reducer in the ¼-inch opening of the valve. This pipe is 20 centimeters long and serves the double purpose of an intake for dry air through a small calcium-chloride tube in the top of the pipe and also as a support for a clamp and the needle used as an index of the degree of distention of the rubber bag. The lower outlet has a smooth nipple with rubber hose leading direct to the air pump. A handle is attached to the plug of the valve in such a way that when the handle is upright connection is direct from the calcium-chloride tube to the air pump. With the handle horizontal connection is made direct to the interior of the can.

### RESPIRATORY VALVES.

Any well-functioning respiratory valve will serve. After testing a number of forms, it became clear to us that no valve as yet devised combined ease of opening and closing, completeness of closure, durability and ruggedness, as well as that valve which made the war gas mask possible, *i.e.,* the valve long known by the unidentifying name of "flutter valve." Believing that the simple and perfect piece of mechanism which was so effective in saving the lives of thousands of people should, if possible, be known by the name of the designer, we have taken special pains to secure the history of this valve, and we are glad to be able to quote from a letter from Dr. C. Gordon Douglas of Oxford, England, to the effect that the valve was designed by Major J. A. Sadd of the English Army. This valve should be called the "Sadd valve."* In gas masks no special housing for the valve is necessary. In respiration apparatus the Sadd valve has already had considerable use and various forms of housing have been employed from the simple wide-mouthed bottle from which the bottom has been cut off[3] to the heavy metallic form of the Rochester laboratory.[4] Visibility is most desirable in a student apparatus, but visibility must at times be sacrificed to ruggedness, and hence a simple, light brass housing, *g,* is indicated in the figure as actually used by us. It must be emphasized that for use with the student apparatus the exact type of the respiratory valve is not important; the form of the housing even less so.

*Sadd valves can be purchased at about 25 cents each from the Mine Safety Appliances Company, Pittsburg, Pa.

### RUBBER TUBES.

The rubber tubes, each usually 80 cms. in length, have an internal diameter of 15 mm. and are commonly of soft rubber, as this fits readily over both valves and the metallic mouthpiece. Ordinary garden hose is equally effective, cheaper, but considerably less flexible, and is more difficult to attach to the mouthpiece and valves. The two tubes join in a metallic piece, *h*, of simple construction* in which may be inserted a moistening device consisting of a small, loosely fitting cylinder of brass gauze, over which cotton or linen has been sewed and then thoroughly drenched with water. To the open end of the metallic piece is attached the rubber mouthpiece.

### MOUTHPIECE.

Although there is considerable difference of opinion among clinicians as to whether the respiratory exchange is best studied when the subject is breathing through a mouthpiece, nosepiece, or one of the various types of respiratory masks, for simplicity of operation nothing compares with the original Denayrouse (*j*) mouthpiece. It is rather difficult to secure, as so far as we know it is made by only one or two manufacturers in the United States. Furthermore, continued cleaning and sterilization by boiling or even by keeping from year to year for class room work would result in deterioration. With these objections in mind we devised a simple, inexpensive mouthpiece which has proved very effective.

A 35 mm. length of thin-walled brass tubing, 19 mm. internal diameter, has a small square-shouldered ring soldered flush with one end. This, when nickel-plated and polished and provided with a rubber shield, makes a most serviceable mouthpiece. The rubber shield to place between the teeth and lips and insure tightness is cut from a piece of heavy sheet rubber in the form of an oval, 83 mm. long by 41 mm. wide, having a 15-millimeter hole punched in the center.

The nickel-plated tube is pushed through this hole and the ring on the end of the tube prevents the rubber from slipping off. A short length of soft rubber tubing connects the brass part of the mouthpiece with the regular connection to the two air pipes. We have found that discarded automobile inner tubes, 4 inches or larger in diameter, which can usually be purchased for a few cents, may be readily used for the rubber shields. On the inside of the inner tube, that is, the side next the wheel, the rubber is usually much thicker, and from this part excellent mouthpiece shields may be cut. The combination of nickel-plated tube and rubber shield has the advantage of being easily cleaned and the expense of deterioration of a specially molded mouthpiece is done away with. Again it is important to emphasize that the form of mouthpiece used is of wholly secondary importance.*

*For student use this mouthpiece may be readily made up of standard fittings of ½-inch pipe.

### NOSECLIP.

Any noseclip may be used. Of the many forms of noseclip now on the market, practically all of which have been tested out at the Nutrition Laboratory and, indeed, found serviceable, none has given as universal satisfaction as that furnished by Siebe-Gorman.† The final closure of the nose is best made at the *end of a normal* expiration.

### SODA-LIME.

The increasing use of respiration apparatus has resulted in the development, and, indeed, patenting of several types of soda-lime and carbon-dioxide absorbents. Practically all of these have received extensive tests at the Laboratory and the one that has found most general use is the original form of soda-lime so long used in connection with the various respiration apparatus in the Nutrition Laboratory. This formula, which has been repeatedly printed, is as follows:

750 grams of unslaked lime and 750 grams of crude commercial sodium hydroxide are each weighed separately. The caustic soda is dissolved in 450 c.c. of water in an iron pot over a gas flame. When this is thoroughly dissolved the lime, which has been previously pulverized, is carefully but rapidly sifted into the pot, the flame turned down, and the whole mass thoroughly stirred *with a long handled iron rod* until slaking is completed. The finished material should be lumpy and slightly moist to the touch, but not so moist as to be sticky nor so dry as to be powdered easily. After cooling, the material is broken into sizes suitable for use. We have found for this purpose that material which passes through a sieve with a mesh of 4 mm. is best.

Although some of the forms of commercial soda-lime will serve the purpose, the best reagent is that which absorbs perfectly carbon dioxide and absorbs water reasonably well, leaving nearly dry air over the soda-lime, and under the bag. The can should be about two-thirds full of soda-lime. The efficiency of this soda-lime for absorption of carbon dioxide and water is so great that such a charge of soda-lime suffices for over 100 experimental periods. If the soda-lime is not impacted, it is efficient. Occasionally the rubber bathing cap should be taken off, the can removed from the support, and the loose soda-lime poured out. This may be returned to the can after breaking up or washing out the impacted soda-lime, which always accumulates around the pipe at the bottom.

*A molded rubber mouthpiece of oval cross section was used on war gas masks and these are being sold extensively in army surplus sales.

†Supplied by H. N. Elmer, 1641 Monadnock Building, Chicago, Ill.

AIR PUMP.

To measure exactly the amount of air introduced to replace the oxygen used by the subject requires a calibrated instrument delivering known volumes of air. As no pressure is required, a well made piston pump, *D*, can be used. Any good automobile tire pump is serviceable, but a reasonably large barrel and correspondingly shorter stroke is of practical advantage. We have found an automobile grease gun with a barrel 1.921 inches (48.79 mm.) in internal diameter and a length of stroke of approximately 194 millimeters very satisfactory.

It is of vital importance that the piston should fit the barrel properly and be well lubricated. Some grease guns are provided with a piston of cork about 2 centimeters long; others with two cupped leather washers set in opposite directions face to face on the plunger rod and held together by a nut and two metal plates to keep the leather spread. Either form, with minor modifications, is satisfactory. Obviously the piston must closely fit the barrel at all times. Certainly there must be no opportunity for air to leak between the leather and the piston rod. Two small sheet-metal disks are commonly used to keep the leather cups spread. We have replaced them with brass disks of slightly larger diameter and drawn the disks and two leather washers well together with a lock washer and a nut on the end of the plunger rod. The lubrication is of fundamental importance. Thus far we have found nothing better than a liberal coating of mutton tallow. Under these conditions the pump does not leak. To provide for an invariable length of stroke of the pump it is necessary to stop the plunger at the end of each stroke, and the simplest method of insuring this is to slip over the plunger rod two short 6-mm. collars of standard one-quarter inch piping, one to be continuously on the inside of the cylinder and the other on the outside. As the pump handle is drawn out, the collar on the inside comes in contact with the metal top so that the soft leather or cork in the piston is not touched. Similarly, as the plunger is pushed into the pump, the small collar, *t*, on the plunger rod on the outside strikes the cap before any part of the piston touches the bottom of the pump. The length of stroke can be altered at will by changing the length of the collar within certain limits, and usually is not far from 185 to 195 millimeters. The usual discharging nozzle of the grease gun is replaced with standard ⅛-inch fittings, a close nipple, an elbow, a small nipple, an elbow, and finally a smooth nipple connecting with a rubber tube to the 3-way valve, *L*.

The measurement of the length of stroke is simple enough, but the measurement of the exact air discharged involves an accurate knowledge of the inside diameter of the pump barrel.

CALIBRATION OF PUMP BARREL.

Rarely are pumps exactly cylindrical, but they are rarely sufficiently out of round to play any rôle in the measurement of the air delivered. The average of 3 or 4 measurements by inside calipers suffices to compute the volume, which in the pumps we have used is 1.872 c.c. per millimeter length of stroke. As a student exercise the exact amount of the air delivered by, say, five strokes of the pump may be readily made as follows. A rubber tube connects with the top of the 3-way valve to a pail of water, in which a 2-liter graduated glass cylinder, previously filled with water, has been inverted. By drawing air into the pump *from* the can and discharging it into the cylinder over water, the air thus discharged may be readily measured. Five complete strokes correspond to approximately 1700 cubic centimeters. The glass cylinder is lowered in the pail until the water level inside and outside is the same. The volume is then read and the temperature of the water and the barometer recorded. Assuming that the cylinder is accurately graduated, the equivalent volume of dry air at 0° C. and 760 mm. can be calculated by the usual formulae. The student exercise is valuable, but not essential to the use of the apparatus. It is an excellent procedure to check occasionally the actual air delivered by the pump.

TESTS FOR TIGHTNESS.

Although there is no measurable pressure in any part of the entire respiration apparatus, the cans and all connections must be absolutely tight. The apparatus should be set up entirely ready for use. A rubber stopper should be placed in the mouthpiece and the rubber bag distended to a moderately rounded form so as to set the index needle* till it just touches the collar button. The degree of convexity of the bag is a rather important point in respiration experiments. As the bag is being filled, there is obviously a vertical as well as a lateral displacement, but towards the end, when the bag is nearly filled, there will be a point where each millimeter in vertical displacement will correspond to but 5 to 10 cubic centimeters of air in the pump. That is, a movement of the piston of 3 to 5 millimeters will produce an elevation of about 1 millimeter in the collar button. This is the ideal point for beginning and ending respiration experiments. After setting the bag a weight of 35 to 50 grams should be placed on top of the bag and allowed to stand for three minutes. If any appreciable leak is present, it will be indicated when the weight is removed, and the position of the index needle and the collar button noted. If a leak is noted, it may be either in the valves or around the can and bag.

*The index needle must be firmly clamped to insure no change in position during an experiment. This is especially necessary, as specific instructions are given to have the button rise and press slightly against the needle. There must be no displacement.

To test the valves remove both while still attached to the rubber tubes, place stoppers in the open end of each valve housing, immerse both in a pail of water, and blow through the mouthpiece. The reagent can and bathing cap can be tested alone by putting rubber stoppers in the two pipes connecting with the can.

By turning the 3-way valve the entire system may be tested at one and the same time, although when well greased with mutton tallow, we have never found leaks in the pump. If the apparatus shows no leak in 3 minutes, it is ready for an experiment.

After the apparatus has been once tested and proved to be mechanically tight, the responsibility of the operator does not cease, for we can recommend in the strongest terms the injunction of Dr. Roth[5] in which he emphasizes that every operator should himself frequently breathe through his apparatus. Not only does this test out any irregularities in the apparatus but also frequently is very helpful to the operator in interpreting any seeming abnormalities that might occur during an experiment.

### TECHNIQUE OF AN EXPERIMENT.

The usual prerequisites for the conditions of basal metabolism measurements are that there should have been a preliminary period of rest, that there should be complete muscular repose during the test, that there is absence of psychical activity or any febrile temperature, and particularly that the subject is in the post-absorptive condition. All these being assured, the technique of the experiment will proceed as follows:

(a) After placing the moistener in the metal pipe connecting the two rubber tubes, the mouthpiece is inserted.

(b) The bag is then filled with oxygen through the petcock at the bottom, starting with the bag flat or slightly depressed into the can. This insures enough oxygen enrichment to preclude any possibility of "oxygen want."

(c) Attach the noseclip, preferably at the end of a normal expiration. When the operator does this, it is helpful to watch the rise and fall of the chest of the subject. The subject can, however, as is frequently the case, apply the noseclip himself.

(d) The bag will now rise and fall with each respiration. Enough air should then be introduced by the air pump* to fill the bag until it touches the needle, indeed until it bulges slightly around the top. Great excess is undesirable, as it is liable to produce pressure against which the subject must expire. In using the air pump the valve, *L*, should be turned so as to connect the pump first with the calcium-chloride tube, *K*, and the pump handle drawn completely out. The valve should then be turned to connect with the can, and the handle slowly pushed to drive dry air into the can.

*Avoid warming the air by placing the hand upon the pump barrel.

(e) At the end of each expiration the button will press less and less against the needle and shortly it will *just touch*. At this point the stop-watch should be started or the exact time noted on an ordinary watch, *recording* first the position of the second hand, then the minute and hour.

(f) Fill the air pump with dry air and slowly drive it into the can.* Make any major movements of the plunger when the bag is high, *i.e.*, towards the end of expiration, to avoid introducing an excessive amount of air into the bag.

(g) As the plunger nears the end of a complete stroke, drive all the air out of the barrel so that a slight excess is present in the rubber bag with slight indications of distention, and wait, as at the start (see e above), until the index just leaves the needle. *Note the time but do not stop stop-watch.* Record the time required for the introduction of one complete pump stroke in minutes and seconds.

(h) Repeat the above for 6 full strokes, noting the total elapsed time in each case.

(i) At the end of the sixth stroke, after noting the time, remove noseclip and mouthpiece, record the temperature of the pump and the barometer. The temperature of the pump is obtained from an ordinary laboratory thermometer with its bulb touching the brass of the barrel.

### CALCULATION OF RESULTS.

The apparent volume of oxygen absorbed during the complete period when six full strokes of the air pump were introduced is computed readily. From the internal diameter of the barrel, the length and number of strokes, the apparent volume of air introduced is computed. With the automobile grease gun we have used this is usually not far from 2100 c.c., and obviously is a constant for any given air pump. There is no tension of aqueous vapor to be considered, for the air drawn into the barrel is dried by calcium chloride, in the tube *K*, and the air over the soda-lime is essentially dry, and thus the apparent volume may be reduced to 0° C. and 760 mm. by the formula

$$V \times \frac{273}{273+t} \times \frac{p}{760}$$

in which t is the temperature of the pump barrel and p the observed barometer. Standard tables giving the combined factor for reducing volumes of *dry* air to 0° C. and 760 mm. have been prepared by Roth,[6] and in more detailed form by Carpenter,[7] and are of great aid to the student in calculating results. But it will do no student harm to learn that gases increase in volume 1/273 for each degree rise in tempera-

*The turning of the 3-way valve may seem confusing, but let students bear in mind that no error that cannot be immediately rectified can be made if the valve is *turned* only when the pump handle is clear in or clear out. If air is inadvertently drawn out of the bag by pulling the handle out, it may immediately be quantitatively returned to the bag.

ture and that the volume increases with decreasing barometric pressure.

Finally, if the reduced volume be divided by the time in minutes,* the oxygen consumption per minute is obtained. The calculation thus is more simply expressed as

$$V = \frac{K \times m}{T}$$

in which K is the constant apparent volume of six full pump strokes, m is the reduction factor at t and p, and T the time in minutes.

While the final time, *i.e.*, the time required to introduce six full pump strokes, may be taken as the measure of the metabolism and the oxygen computed directly therefrom, it is obvious that this time is computed from but two readings, *i.e.*, that at the beginning and that at the end of the experiment. The error in reading is normally very slight. At no time will the index needle be farther than 1 millimeter from the top of the bag at the time of reading, *i.e.*, a difference representing hardly 10 c.c. Almost invariably it will be very much less than that. But there may be an abnormally shallow or abnormally deep respiration just at the beginning or the end. Such respirations would affect the calculations of the entire experiment. Before computing the results, therefore, it is best to inspect the actual times required for the absorption of each pump stroke, and they should be reasonably regular and approximate multiples of the time required for the first full stroke. The simplest method of inspecting these accurately, however, is to plot them on a piece of plotting paper with the time as the ordinates and the number of pump strokes as the abscissae. Usually all seven points (including the zero) will fall in a straight line, which may be taken as the slope of the oxygen absorption. Under these conditions great confidence may be held in the last figure. Even provided this last reading is aberrant, the oxygen consumption can be computed from the slope of the line very accurately indeed. One has but to see at what time the oxygen slope cuts the line corresponding to the sixth pump stroke.

### RECORD OF A TYPICAL EXPERIMENT.

A typical experiment was made on a normal subject, a woman, 24 years of age, weighing (nude) 57.2 kilograms, and with a height of 157 centimeters. The room temperature was 19.6° C., the temperature of the pump was 18.3° C., and the barometer stood at 755.9 mm. Table 1 indicates the elapsed time from the beginning of the experiment to the complete consumption of the oxygen represented by the air discharged at the several strokes of the pump.

*It is necessary to convert the time as recorded in minutes and seconds to decimal parts of a minute. Thus, 11 minutes and 27 seconds equal 11.45 minutes. Failure to make this conversion is often noted in calculations sent by others to the Nutrition Laboratory for inspection and comment.

TABLE 1.

*Time Required for 6 Pump Strokes in Experiment with Student Apparatus.*

| Pump stroke No. | Elapsed time mins. | secs. |
|---|---|---|
| 1 | 1 | 56 |
| 2 | 3 | 54 |
| 3 | 5 | 50 |
| 4 | 7 | 46 |
| 5 | 9 | 36 |
| 6 | 11 | 27 |

Six full strokes with a length of stroke used in this particular apparatus corresponded to 2168 c.c. apparent volume. From the tables for the reduction of volumes of air to 0° C. and 760 mm. it can be seen that at the temperature of the pump, namely, 18.3° C., and with the barometer at 756 mm., the factor is .932. The time for the six strokes is expressed as minutes and decimal parts of a minute, namely, 11.45 minutes. The formula $\frac{K \times m}{T}$ thus equals

$$\frac{2168 \times .932}{11.45} = 176 \text{ c.c. } O_2$$

The above experiment, as indeed most of the experiments that will be made with this apparatus, was under basal conditions. It is obvious that in the physiological laboratory many problems with superimposed factors, such as digestive activity and light muscular contractions, may readily be studied by groups of two or more students.

With this apparatus, therefore, it can be seen that the calculation involves a knowledge, first, of the total apparent volume resulting from six complete strokes. This is uniform and is a function of each pump and in all calculations is constant. Second, the factor required to reduce the dry air to 0° C. and 760 mm. from the temperature of the pump (t) and the observed barometer (p) must be known. It would seem as if the calculation of so prominent a factor as metabolism, after having been thus reduced to these simplest terms, would not lend itself to much further simplification. Innumerable diagrams, charts, nomograms, and artificial indices have been proposed to "sugar-coat" these calculations. Inasmuch as further simplification in our judgment relieves the student of altogether too much responsibility and certainly minimizes the understanding of the subject, we are quite inclined to agree with Dr. E. F. Du Bois (than whom none other has done more to further the intelligent study of metabolism in medical schools) when he states that the "time saved by the modern technical improvements should be devoted to the study of text books on nutrition,"[8] to which we may perhaps be permitted to add "including an intelligent study of the methods of computation."

### CALCULATION OF THE HEAT PRODUCTION.

The measurement of the oxygen consumption per minute, as outlined above, is of value chiefly as furnishing the means for the direct computation of the heat production. Each liter of oxygen absorbed in metabolic transformations is accompanied by the liberation of approximately 5 calories of heat. The exact calorific value of a liter of oxygen varies from 4.686 to 5.047, varying directly as the respiratory quotient. The respiratory quotient of .70 has the lower value and 1.00 the higher value. With a diabetic on strict diet, with a minimum amount of carbohydrate on the day before the experiment, the combustion will be largely fat, and the calorific value of 4.714 at a respiratory quotient of .73 would represent approximately his metabolism. A normal subject, having a liberal carbohydrate diet the day before, may have a post-absorptive combustion largely of carbohydrate, and the respiratory quotient, as a matter of fact, may approach 1.00 so the calorific value may be nearer 5.047. The theoretical limits for the respiratory quotients of normal men in the post-absorptive condition are .72 to 1.00. The probable limits are nearer .73 to .95. The calorific value of oxygen at .73 is 4.714 calories per liter and at .95 is 4.985 calories. The difference is .271, which makes the maximum variation either side of the calorific value for the average quotient of .84 amount to 2.8 per cent. The average respiratory quotient of a large number of men and women studied in this Laboratory was shown to be .82. Under these circumstances, even with the widest probable ranges of respiratory quotients the calorific value of oxygen would hardly vary plus or minus 3 per cent.* Indeed, Krogh[9] recommends a diet for one or two days before the experiment, which he considers will yield a post-absorptive respiratory quotient lying between 0.8 and 0.9. But it is hardly worth while to go to this trouble for clinical work, and for student exercises it is in no sense necessary.

Assuming, however, an average respiratory quotient of .82 in the post-absorptive condition, with a calorific equivalent per liter of oxygen of 4.825 calories, the heat production from the oxygen per minute is readily obtained. Thus, in the illustrated experiment where it was found that 176 c.c. of oxygen were consumed per minute, it can readily be computed that this corresponds to a heat production of .849 calories per minute, 51.0 calories per hour, and 1223 calories per 24 hours. This calculation has likewise been made by Dr. T. M. Carpenter[10] for all values of oxygen consumption per minute from 151 c.c. to 300 c.c.

### TESTS OF THE ACCURACY OF THE STUDENT APPARATUS.

The commonest method for testing the accuracy of the various forms of respiration apparatus has been to compare several forms of apparatus with each other, using a human subject as the means for comparison. Innumerable tests in this Laboratory have shown the accuracy of the portable apparatus using the electric air impeller and without valves[11] as an accurate method of measurement of metabolism compared with other forms of respiration apparatus. We have tested the student apparatus with the best model of portable apparatus that we have in the Nutrition Laboratory, and on a subject upon whom several thousand respiration experiments have been made in the Laboratory during the past five years. In the series of comparison tests reported in Table 2 the first two periods were made with a regular portable apparatus, the next four with the student apparatus, and the last with the regular portable apparatus. The agreement is all that could be desired and shows that the student apparatus is certainly, with a well trained subject, as capable of measuring the oxygen consumption as is the best type of portable apparatus with which we are familiar.*

Fortunately a method[12] of testing various types of respiration apparatus has been perfected by our associate, Dr. T. M. Carpenter, and the student apparatus has been subjected to tests with this new method. Dr. Carpenter's method consists in burning known volumes of alcohol in a stream of oxygen-rich air which is circulated through the apparatus by attaching a small spirometer to the mouthpiece of the

*Objections to the use of high oxygen in apparatus of this kind have recently been raised from two important laboratories (Means and Davies, *Edinburgh Med. Jour.*, January, 1922; Bradley, *Wisconsin Med. Jour.*, 1922, 20, p. 6). One author maintains that there may be an error of 60 per cent., *i.e.*, plus or minus 30 per cent., in such measurements, and the other an error of 30 per cent., *i.e.*, plus or minus 15 per cent. We find ourselves entirely unable to agree with either of these critics, for a consideration of the respiratory quotient and the calorific value of oxygen at these quotients shows that the possible error would be very much less, about one-tenth. Were the measurements based solely upon carbon dioxide, then the criticisms would surely apply. Dr. Meakins further objects to the breathing of high oxygen on the ground that it has been shown by Dautrebande and Haldane (*Jour. Physiol.*, 1921, 55, p. 296) to slow the pulse rate, that there is retardation of the pulse rate when breathing high oxygen has long been known. (See Benedict and Higgins, *Am. Jour. Physiol.*, 1911, 28, p. 1.) That this has no measurable effect upon metabolism, however, is shown by over 200 of their experiments.

*While it is the experience of every subject who has breathed through valves of even the lowest degree of resistance and upon a portable apparatus fitted with an air impeller, that the breathing is much easier without the valves, it is quite clear from this and other tests that the presence of valves is without any significance whatsoever on the oxygen measurement, certainly so far as the clinician is concerned, and in consideration of the fact that the technique using the air impeller in an oxygen-rich atmosphere has not been mastered by a large number of users of the apparatus, we recommend strongly that for clinical work valves be employed and not the air impeller. Valves have been attached to the regular portable apparatus in accordance with a suggestion made by Dr. Roth (Boston Med. and Surg. Jour., 1922, 186, p. 457) and the apparatus functions perfectly. For those who have not this newer modification the attachment of valves outlined in this paper or as outlined in Dr. Roth's paper may be made directly with the original form of Benedict-Collins portable, one valve being attached to each of the tubes at the base of the spirometer. It is only necessary to insure that the connection between the bottom of the soda-lime can and the pipe leading out of the spirometer is well made, preferably with a piece of good soft rubber tubing cut to serve as a gasket. It is our belief that the portable apparatus with a rotary air impeller inside is still the best apparatus of this oxygen-rich breathing type. Next best will be that type with the blower outside, but all types using valves require an appreciably greater resistance to breathing, which, however, is *absolutely without significance in the oxygen measurements and hence perfectly adapted for clinical work.*

TABLE 2.

*Oxygen Consumption per Minute.*

Subject, Miss W.

| Period. | Apparatus. | $O_2$ per min. c.c. |
|---|---|---|
| I | Regular portable | 186 |
| II | " " | 185 |
| III | Student apparatus | 194 |
| IV | " " | 183 |
| V | " " | 183 |
| VI | " " | 189 |
| VII | Regular portable | 185 |

student apparatus, and the spirometer, being raised and lowered by an electric motor, acts as a small pump. Under these conditions the spirometer takes the place of the lungs; air is circulated through the apparatus and through the valves exactly as in normal respiration. From the amount of alcohol burned in a given time and the amount of oxygen or air pumped into the bag, the calculation of the relationship between the oxygen admitted and the oxygen theoretically required to burn the alcohol may be readily made. The test reported in Table 3 consists of 8 periods with the student apparatus, each approximately 10 minutes long. The percentage of theory of the oxygen found is given in this table and, since the flow of alcohol was purposely slowed during this series of tests in order to give some conception as to the accuracy of the apparatus for measuring large as well as small amounts of oxygen, the oxygen consumption per minute in cubic centimeters is also reported. It can be seen that during the eighth period the oxygen consumption was but about one-third that in the first period. The data in Table 3 show that this student apparatus, used as outlined herewith, makes it possible to measure the oxygen absorbed by the burning of an alcohol lamp with a very high degree of accuracy.

TABLE 3.

*Alcohol Check Test with Student Apparatus.*

| Period. | $O_2$ per min. c.c. | Per cent. theory. |
|---|---|---|
| I | 211 | 98.8 |
| II | 178 | 100.0 |
| III | 132 | 100.4 |
| IV | 125 | 101.7 |
| V | 129 | 98.4 |
| VI | 114 | 99.5 |
| VII | 93 | 97.8 |
| VIII | 82 | 99.6 |

### VITAL CAPACITY.

This apparatus also lends itself to the determination of the vital capacity in the laboratory. For this purpose the two rubber tubes are temporarily closed by either folding in the hand tightly or by a large clip. The air is pumped into the bag until the index touches the needle. Then by reversing the usual operation, *i.e.*, by withdrawing the air out of the can into the pump and discharging it through the calcium-chloride tube, 12 to 15 complete strokes may be thus discharged before the bathing cap has withdrawn into the can sufficiently to produce any noticeable tension. A careful record of the number of strokes is kept. Then the subject, whose vital capacity is to be measured, expels forcibly in accordance with the usual instructions and the thumb is quickly placed over the mouthpiece after the complete maximum expiration. This mouthpiece is held closed until the end of the operation, which is finished by noting with the regular technique the number of pump strokes of air required to bring the bag back to its original state of distention. In this case in all likelihood it will not be an exact number of full strokes. But the measurement of the length of stroke remaining undischarged into the bag and the proportion to the total length of stroke give a simple calculation of the last fraction actually delivered.

In this test, however, it is important to note that the carbon dioxide thus expelled will be absorbed by the soda-lime, and a slight additive correction should be made. Assuming that the carbon dioxide in the total air expelled in the vital capacity test is approximately half that of alveolar air, *i.e.*, 3 per cent., the total volume as measured by the student apparatus should be increased by about 3 per cent. Where a carefully calibrated spirometer is available, its use is preferable. We believe that the student apparatus will, however, measure the vital capacity, expressed as *dry gas volume*, fully as accurately as any gas meter.

### LIMITATIONS OF THE APPARATUS.

This apparatus is presented solely for the use of medical schools and physiological laboratories. It will measure the oxygen consumption with an accuracy fully equal to that of the better forms of spirometer apparatus. Relinquishing the geometrical cylinder of the spirometer bell as an expansion chamber and substituting therefor the irregular shaped bathing cap, graphic tracings of the respiratory mechanisms are precluded. This is a distinct defect, for the visualization of the mechanics of respiration on a tracing (such as is regularly obtained in all the Nutrition Laboratory researches) from which can be computed the volume per minute, the volume per respiration, and particularly a study of the various types of irregular respiration noted in disease and in sleep, is of the greatest pedagogical value.

This apparatus likewise does not lend itself primarily to the new technique for demonstrating the absence of leaks during the actual progress of the experiment, which has been so successfully introduced in connection with the regular portable apparatus of the Nutrition Laboratory. By placing a weight on top of the spirometer bell when the experiment is half through

and noting any change in the rate of fall in the last half of the experiment, a leak is instantly shown. With the bathing cap this procedure is difficult, although we have made a number of tests and plotted the time required for the last three strokes of the pump. With a good mouthpiece, however, leaks are very rarely found.

### MODIFICATIONS.

The essential principles of the apparatus are simplified, we believe, to the extreme. Certain modifications can, of course, be thought of and a number of variants introduced, primarily the exact size of the soda-lime can. This could be reduced to a very small size, containing only soda-lime enough for one or two experiments. Undoubtedly other types of piston pump can be substituted. As noted in the text, we have made a number of successful experiments with an ordinary automobile tire pump. The apparatus could conceivably be mounted upon a heavy base tripod and the air pump plunger operated in a vertical direction. This is impractical, as the lubrication and absolutely essential tight fit of the piston preclude easy operation other than on a horizontal mounting. We can only hope that the form as here presented will be seen to be so simple and inexpensive that other forms which cannot be tested as thoroughly and accurately as this has may not be used, with the danger of unsatisfactory results.

The apparatus may, under certain strict conditions, be used for re-breathing tests of basal metabolism. By removing both valves, placing a rubber stopper in the upper opening, *a*, and a 60-centimeter length of $\frac{5}{8}$-inch rubber tubing with a mouthpiece on the under opening, *b*, the subject may, after enrichment, breathe into the apparatus without valves and the oxygen consumption thus be determined by the regular technique and, indeed, with considerable accuracy. The enlargement of the "dead space" by the length of rubber tubing is not accompanied by obviously labored breathing,[13] but as the soda-lime is exhausted near the pipe in the bottom of the can the dead space is continually becoming larger and larger. This method of measuring metabolism is physiologically very unsound, and is permissible only with constant renewals of soda-lime in the can.

### SUMMARY.

To aid in introducing to medical students the fundamentals of gaseous metabolism measurements a simple type of apparatus is described, involving the breathing of a confined volume of oxygen-rich air and measuring exactly the amount of oxygen absorbed by the lungs of the subject. A can, two-thirds filled with soda-lime, a bathing cap for expansion, two "Sadd" valves and housings, with rubber hose and mouthpiece, comprise the respiration system. Dry room air is forced quantitatively by an automobile grease gun, acting as an air pump, into the can as the oxygen is absorbed. From the volume of 6 full strokes of the air pump, the temperature of the pump, the barometer, and the time in minutes, the actual oxygen consumption is rapidly computed. The apparatus lends itself also to the determination, by students, of the vital capacity.

### REFERENCES.

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2 Benedict: Deutsch. Arch. f. klin. Med., 1912, 107, p. 156.
3 Roth: Boston Med. and Surg. Jour., 1922, 186, p. 460.
4 Boothby and Sandiford: Basal Metabolic Rate Determinations, Philadelphia, 1920, p. 39.
5 Roth: Boston Med. and Surg. Jour., 1922, 186, p. 463.
6 Roth: *Ibid.*, p. 496, Table 1.
7 Carpenter: Carnegie Inst. Wash. Pub. No. 303, 1921. Table 9, p. 71, gives the logarithm of the factor, and Table 10, p. 87, gives the factor itself.
8 Du Bois: Jour. Am. Med. Assn., 1921, 77, p. 356.
9 Krogh: Wien. klin. Wochenschr., 1922, 35, p. 290.
10 Carpenter: Carnegie Inst. Wash. Pub. No. 303, 1921, p. 105, Table 14.
11 Benedict and Collins: Boston Med. and Surg. Jour., 1920, 183, p. 449.
12 Carpenter: Carnegie Inst. Wash. Pub. No. 216, 1915, p. 80.
13 Carpenter: *Ibid.*, p. 219.

## THE ETIOLOGY AND CLINICAL FEATURES OF LUNG ABSCESS.*

BY JOHN HOMANS, M.D., BOSTON.

[From the Surgical Clinic of the Peter Bent Brigham Hospital, Boston.]

Abscess of the lung appears to be a complication of pulmonary infection rather than a disease *per se*. As such it has long been known to have a rather low incidence. But with the enormous development of operative surgery which the last fifty years has witnessed it has taken on a new significance as a postoperative accident. It is mainly to this side of the matter that I wish to direct your attention. Study of a series of twenty-three cases at the Peter Bent Brigham Hospital and a comparison of this short series with larger groups of other clinics show the usual etiologic factors, the generally accepted diagnostic signs, the average course and response to treatment which we are accustomed to see.

*Etiology.*—By far the larger number of cases were postoperative. There were 10 instances of abscess following operations upon the mouth and throat, of which 7 were tonsillectomies and 3 teeth extractions; 3 instances of abscess following abdominal operations (1 cholecystectomy, 1 herniotomy, 1 appendectomy); 4 instances of abscess complicating pneumonia (as judged by the history), variety unspecified; 1 instance of abscess following influenza (which may be presumed to have been complicated by broncho-pneumonia); 3 instances of unknown etiology (presumably respiratory infections); 1 instance of exposure to fumes at a fire; and 1

*Read before a meeting of the Boston Surgical Society, December 4, 1922.

instance of association with substernal goiter.

Thus, 13 instances of postoperative lung abscess are found in a series of 23 cases, showing the marked preponderance of operation as an exciting cause.

This at once suggests the inhalation of septic material under a general anesthetic as a source, a matter which has long been under debate in the case of postoperative pneumonia. At first sight the large proportion of abscesses following mouth and throat operations in this series—10 out of 13—would seem to back up the aspiration hypothesis. Yet when one considers the immense number of such operations which are now being performed as compared to the number of abdominal operations, the proportion—10 to 3—seems rather less significant. The causal relationship of tonsillectomy and tooth extraction to abscess is difficult to study, since patients seldom remain in the hospital after mouth and throat operations long enough to develop abscess of the lung while under observation, and when they do develop the disease tend not to return to the same clinic.

In order to begin at the beginning in studying the aspiration hypothesis, let us take up first the localization of aspirated material. Jackson*[1] finds that gross foreign bodies enter the right primary bronchus in preference to the left, the proportion being between 62% and 75% in favor of the right side, according to the various investigators he quotes. The bronchi leading to the lower lobes rather than to the upper are invaded by preference. It is a matter of some interest that these foreign bodies are not a frequent cause of the sort of abscess we are accustomed to see, for examination of the literature of bronchoscopic surgery shows that these objects either set up quite local inflammatory reactions, or in case they are particularly irritating, diffuse "sponge soaking," which is in effect bronchiectasis. However, the fact seems to be established that the right side of the lung, and especially the right lower lobe, receives most foreign material. Jackson states, moreover, that the bronchus leading to the right middle lobe is almost never invaded and that foreign bodies in the bronchi of the upper lobes are more often pushed in by the unskilled bronchoscopist than carried in by natural means.

If inhalation of infected blood or tonsillar secretion or tonsillar fragments is to be regarded as an exciting cause of abscess of the lung, we should be able to demonstrate that the distribution of abscesses after operations in the mouth and throat is such as would be more consistent with aspiration of this material than with any other factor. What, then, is the distribution of these abscesses? In this series of 10 abscesses which followed tonsillectomy or tooth extraction seven were in the right lung and three in the left, an apparent confirmation of the aspiration hypothesis. But in the distribution to the various lobes this confirmation is wanting, for there were: Right—Upper, 1; middle, 3; lower, 3. Left—Upper, 2; lower, 1. If the right primary bronchus carries down to the lower right lobe most of the septic material aspirated, how is it that even in this short series there are two abscesses in the left upper lobe, three in the right middle and one in the right upper lobe? That the so-called "aspiration" or postoperative abscess is more likely than the postpneumonic to be found in the upper lobes and less likely to be found in the lower has been repeatedly observed. Lemon[2] in his discussion of a series of 81 cases observed at the Mayo Clinic, in 1919, gives information on this point: Location of Abscess—Upper lobes, after pneumonia, 5; after aspiration, 7; unknown cause, 3. Lower lobes, after pneumonia, 28; after aspiration, 9; unknown cause, 8. Whittemore[3] states: "It is the general belief that the majority of abscesses are situated in the lower lobe, and this would seem reasonable to suppose, especially in those cases due to aspiration, but this has been contrary to the findings in my series of cases. In 22 cases the abscess was in the upper lobe, in 19 it was in the lower lobe."* Wessler,[4] in a study of 100 lung abscesses, 26 of which were postoperative (21 tonsillectomies), finds among these 26 that the upper lobes were involved twice as often as the lower. The very ample statistics collected by Lockwood[5] together with his own series at the Mayo Clinic give the same impression. To these rather positive statements and figures the recent important investigation of Moore,[6] of Chevalier Jackson's Clinic, offers a contradiction. Moore sent a questionnaire to 1020 laryngologists, and from 144 of these received records of 202 instances of lung abscess following tonsillectomy. In 91 of these, the exact location of the abscess was not stated, but even if this omission robs his statistics of some of their value, the remaining 111 cases give only 32% for the middle and two upper lobes to 60% for the two lower. And there were reported 63% of right-sided infections to 29% left sided. In a personal communication, Moore states, moreover, that the distribution of abscesses which have followed operations on the tonsils under a local anesthetic is the same as that following a general anesthetic, and that in Jackson's clinic they are regarded as due to aspiration. Thus, Moore finds in his larger statistics that the preponderance of upper lobe infections which other observers have noted for the post-tonsillectomy abscess is not apparent.

However we attempt to reconcile this conflicting evidence in a consideration of the origin of upper lobe infections, we should not ignore the possibility of the direct lymphatic route from

*Jackson's reasons for invasion of the right lobe rather than the left are (1) the greater diameter of the right primary bronchus, (2) its smaller angle of deviation from the trachea, (3) situation of the carina to the left of the axis of the trachea, (4) the action of the trachealis muscle, and (5) the greater volume of air going into the right bronchus.

*Whittemore does not separate the post-tonsillectomy abscesses from those due to other causes.

the tonsil to the lung. In the case of tuberculosis, this route has received considerable attention, and the association of the roentgenological "pleural cap" with early apical tuberculosis, on the one hand, and tubercular tonsils, on the other, has been shown (Van Zwalenburg and Grabfield[7]). Moreover, the abundant lymphatics of the visceral pleura drain toward the lung hilus (Miller[8]). If this route is indeed available, an explanation of the frequency of upper lobe abscesses after operations upon the tonsils and teeth is at hand. Indeed, it appears more reasonable than the extension of infection through veins injured or opened during tonsillectomy, as maintained by Richardson.[9]

That lung abscesses, due to *all* causes, have a strong right-sided and lower lobe preponderance is attested by all available statistics. This series gives: Right—Upper, 4; middle, 3; lower, 7. Left—Upper, 4; lower, 5. Total right sided, 14, or 61%; total left sided, 9, or 39%; total lower, 12; total upper, 11; and by taking Lockwood's chart of accurately located abscesses from all sources, much the same findings are obtained: Right—Upper, 40; middle, 24; lower, 67. Left—Upper, 13; lower, 49; total right, 131, or 68%; total left, 62, or 32%; total lower, 116, or 60%; total upper and middle, 77, or 40%. For greater ease of comparison let us return to Moore's percentages: Total right, 63%; total left, 29%; total lower, 60%; total upper and middle, 32%.

Thus, Moore's distribution of post-tonsillectomy abscess is almost exactly that of abscess due to all causes.

Having established with a reasonable degree of accuracy the localization of abscess in the various pulmonary lobes, it occurred to me to compare this distribution with that of a number of other localizable diseases of the lung, and I was able to obtain this evidence for lobar pneumonia, pulmonary embolism and, to a limited extent, for primary cancer.

The large statistics collected by Babcock[10] for lobar pneumonia show that in 1500 lobar pneumonias, part or all of the right lung only was involved in 52%; part or all of the left lung only was involved in 35%; the lower right lobe, alone or in combination with some other lobe of the same lung, was involved in 33%, or more than twice as often as any other lobe. In 16,600 lobar pneumonias (Juergensen's statistics, *cit.* Babcock) the right lung alone was involved in 53.1%, the left lung alone was involved in 36.5%.

Thus, the distribution of lung abscess shows a proportion of right lung infections very similar to that found in lobar pneumonia, and the right lower lobe is involved quite as often in pneumonia as in abscess. The figures given by Rupp[11] for the localization of embolism and infarction in a large series of postmortems shows a preponderance of right-sided lesions almost identical with that of abscess: 61% for right lung to 39% for the left. In respect to cancer, the same right-sided and lower lobe preponderance has been observed. Haberfeld[12] in a study of 68 autopsies finds: 44 cancers (64.7%) originating on the right to 24 (35.3%) on the left; 24 cancers originating in the right primary bronchus to 15 on the left; and 21 cancers taking origin in the lower lobes to eight in the two upper and right middle. Adler's[13] figures, though larger, are collected from many sources and show, among 345 cancers confined to one lung or the other, 55% of right lung involvement to 45% left.

We are justified in believing, therefore, that the wear and tear of life falls more on the right lung than the left. It has three lobes, as against two and is about 10% larger by volume than the left, if one may judge from Krause's old figures, so that on the doctrine of chances it would suffer more from localized disease. And it receives more emboli through the blood stream. The right primary bronchus is slightly larger than the left and is more directly in line with the trachea, so that in the natural process of respiration it gives admission to more floating material, bacteria, etc., both in conscious and unconscious states. Undoubtedly the right lower lobe suffers most of this wear and tear, receives more gross foreign bodies and is more exposed to the irritation of ether.

From these anatomic and clinical observations it may be inferred that abscess of the lung has such a distribution in the pulmonary area as might be expected from any infection however carried to the lungs, with the exception that those abscesses resulting from surgical operations, particularly those performed upon the mouth and throat, have a tendency perhaps to appear in the upper lobes in undue proportion. The aspiration hypothesis, even if true, is therefore not required. And if the generally accepted location of the postoperative abscess is correct, the distribution of these abscesses is even opposed to this hypothesis since these lesions which, if aspiration were a factor, should be found almost exclusively in the lower lobes, are quite common in the upper. Moreover, as Moore has discovered, no inconsiderable number of abscesses follow throat operations under local anesthesia, a fact analogous to the well-recognized occurrence of pneumonia after abdominal and other operations performed under local anesthesia (Cutler and Hunt[14]), where aspiration may as a general rule be disregarded.

A great deal of stress has been laid upon this angle of etiology since it is properly a subject of controversy and may be made the basis of progress in lessening the incidence of a very dangerous condition. Other etiologic factors are generally accepted. Abscess of the lung is a disease principally of middle life and affects males three times as often as females. Most observers feel that the actual development of ab-

scess is preceded by a pneumonic consolidation, even in the postoperative form of the disease. But whether the abscess arises from a definite pneumonia—more often a broncho-pneumonia than of the lobar type—or after an operation, there is an interval, a sort of prodromal stage varying in length and characterized by continuous or intermittent fever, malaise, and in many instances of pleuritic pain and dry cough, while the infected lung is undergoing liquefaction. The lesion is more often peripheral than central, a fact which Hartwell[15] has held to be important in prolonging the interval before the abscess can rupture into a bronchus.

The bacterial cause of this liquefaction appears to be the Staphylococcus aureus. In that case, one may suppose that it is this organism—a natural liquefier of tissues—which affords an opportunity for secondary invaders of the putrefying type to give their characteristic touch to the picture. Anaerobic bacilli have often been observed in the sputum, even the gas bacillus, as one would expect in a process with which some degree of gangrene is almost always associated. It has been noted in other series that an antecedent tuberculosis predisposes to a frank lung abscess. In several patients of the Brigham series, the previous history has suggested tuberculosis, though the tubercle bacillus could never be found in the sputum. Two of these cases proved fatal and no autopsies could be obtained, but other observers have followed such patients to a cure of the abscess and have been able subsequently to find the tubercle bacillus.

### CLINICAL FEATURES.

The case with which fully developed abscess of the lung is habitually recognized is sufficient evidence that it consistently presents a characteristic picture. Only with bronchiectasis is serious confusion likely to arise and this only when the onset of lung abscess has been unusually insidious, the constitutional symptoms mild and the x-ray picture indeterminate. For abscess, which almost invariably shows itself from a few days to three weeks following an obvious respiratory infection or an operation, is a disease of well-marked onset, while bronchiectasis is a condition of gradual development, insidious increase in sputum and less marked constitutional symptoms. As Whittemore has pointed out, the two diseases fully developed may be confused, especially in a foreigner from whom a history is unobtainable, but a careful history and sputum examination rarely fail to determine a diagnosis.

Since the onset of lung abscess is so infrequently observed in hospital, the history of three patients who developed the disease while under observation at the Brigham Hospital may be not without value.

Case 1. D. P., Surgical 7411; male; age 39 years. The patient was operated upon September 24, 1917, at the Brigham Hospital for gallstones. Ether anesthesia by the Connell apparatus (tube passed into pharynx through the nose). A large amount of ether was required to induce anesthesia, after which no difficulty was encountered. A thick-walled edematous gall-bladder was removed and stones were taken from the common duct, which was drained. Recovery from the anesthesia was uneventful. On the night of operation a rise of temperature, pulse and respiration took place and the respirations averaged 35-40 for the next two days. No signs were detected in the lungs for the 10 days following operation, during which the fever and rapid respirations gradually subsided. Unfortunately no x-ray was taken. Three weeks after operation the patient was up and about but was running a fever without physical signs. At about this time he began to cough and the breath became foul, but the foul sputum of lung abscess was not noted for some four weeks after operation. There was dulness in the right axilla and the x-ray showed an abscess in the upper right lobe, the size of a golf ball. (Fig. 1.) Operation, November 1, 1917,

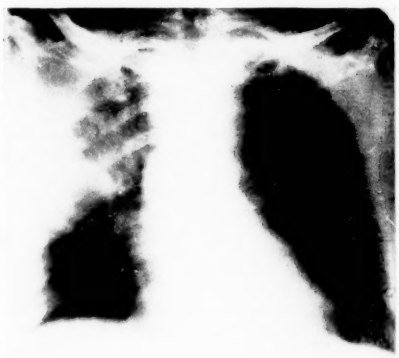

Fig. 1.—Case 1. (D. P., Surg. 7411.) Postoperative abscess of right upper lobe. Note the diffuse infiltration of the right upper lobe above the abscess proper. Patient cured by operation.

disclosed an abscess beneath the third rib in the mid-axillary line (upper lobe) close to the surface. The patient recovered and reported himself well three years later.

This case represents a rather mild postoperative lesion in which there was evidence of a pulmonary infection almost from the hour of operation, but in which the abscess itself was slow to develop. The patient was of the heavy stocky type which so often suffers from bronchitis or broncho-pneumonia after upper abdominal operations. The situation of the abscess was not consistent with aspiration of septic material as

an etiologic factor. The source of the infection may have lain in the gall-bladder. It certainly could not be demonstrated in the mouth or throat in this instance.

Case 2. A. S.; Medical 7330, Surgical 7801; male; age 56 years. Six weeks before entrance to the Medical Service of the hospital, the patient had suffered a severe tonsillitis from which he never completely recovered. Four weeks later he developed acutely inflamed joints, purpuric rash and attacks of sweating. At entrance his tonsils were red; his teeth in advanced decay with pyorrhea. Three weeks after entrance, 14 teeth were removed under ether with immediate exaggeration of his rheumatism. One month after this operation a foul abscess which had formed in a tooth socket was opened and the bone curetted under ether. On the following day the patient began to cough up purulent foul blood-tinged sputum. Pain in the right lower chest. Area of dulness in the right lower back. He was transferred to the Surgical Service, where two weeks after the development of the abscess the ninth and tenth ribs were resected under novocain, the lung found free and the abscess not located. The patient died 16 days later.

Postmortem examination showed an abscess in the right lower lobe, an acute endocarditis and multiple infarcts of the kidney.

The case is one in which foci of infection were evident in the teeth and tonsils and were undoubtedly responsible for the acute articular rheumatism. Whether or not aspiration of septic material occurred at the second operation, it is difficult to escape the conclusion that infection was spilt into the blood stream on both occasions and set up a septicemia when the jaw was curetted. A more conservative treatment of the mouth might have avoided the fatal complication. In a patient of this age a lung abscess was almost certain to be fatal.

Case 3. E. D.; Surgical 4119, 7911, and Medical 4149; male; age 49 years. A worker in a rubber factory. Entered hospital for cure of inguinal hernia. Teeth noted as showing considerable decay and pyorrhea. Moderate postnasal discharge. Herniotomy, January 12, 1916, under ether. Induction prolonged with cyanosis and struggling. Temperature 99° to 100.5° daily for the following week. Wound reactionless. On the seventh day râles were noted in the right lower back and the temperature rose to 103°. On the thirteenth day a cough developed with moderate expectoration which was not foul. An area of dulness appeared at the left base. No pain. X-ray showed exudate within and about the bronchi at the left hilus. Later the cough became dry, and on the thirty-eighth day foul sputum containing elastic fibers was noted. The patient refused operation but returned a month later, when the left seventh rib was resected under ether, the lung found adherent and a small abscess drained. His cough never cleared up. About a year later he returned to the hospital with severe cough and bloody sputum. No tubercle bacilli were found. A second operation disclosed a series of small scarred cavities passing inward toward the hilus and opening into a large bronchus. Very little improvement resulted. His death was reported two years later.

This case would appear to be one of postoperative broncho-pneumonia from which an abscess developed. Both lungs were involved but abscess occurred only in the left. The mouth offered an obvious source of bacteria. As in Case 1, there was evidence of pulmonary infection from the start. The disease would ordinarily be regarded as of the aspiration type and should, like Case 1, have been favorable for cure had the patient been younger.

These three patients are the only ones in which the development of abscess has been observed at the Brigham Hospital and are representative of a postoperative etiology. The wide variation in onset and subsequent behavior of the disease in these cases illustrates the absurdity of claiming for lung abscess any such definite period of development and characteristic onset as is described by some writers.

Other patients in whom, however, the antecedent conditions were not observed, are sufficiently representative of a very different origin.

Case 4. W. R.; Medical 4833, Surgical 5025; male; age 45 years. The patient had had a chronic cough for some time before his acute illness developed. After three to four weeks of illness he appeared emaciated, a hint that he had previously suffered from a debilitating dis-

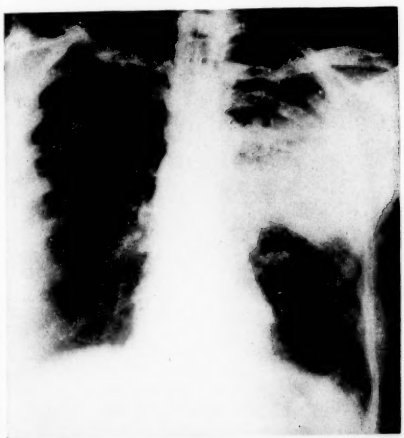

Fig. 2.—Case 4. (W. R., Surg. 5025.) Abscess following chronic cough suggestive of tuberculosis. Note diffuse infiltration in upper left lobe. A trabeculated abscess close to the lung surface was found at operation. Fatality.

ease. Three and a half weeks before entrance the patient was awakened by pain in his left side. Paroxysmal cough appeared and he soon began to bring up yellow foul sputum. Examination showed dulness in the upper left back, with evidence of a general bronchitis. X-ray showed an infiltration suggestive of abscess in the left upper lobe. (Fig. 2.) No tubercle bacilli were found in the sputum. The patient was acutely ill. Four weeks later a trabeculated abscess near the surface of the lung was drained under novocain. The patient died in 24 hours and no autopsy was permitted.

This case represents a group in which previous pulmonary disease may be presumed to have existed. One would suspect tuberculosis though sputum examination had not demonstrated it. Such cases have proved fatal or incurable in this series.

There remain to be described two very typical instances of the post-tonsillectomy abscess, evidently the most common of the postoperative group. These two cases have been selected, as they illustrate aspects of progress and treatment particularly characteristic of this type.

Case 5. A. G. F.; Medical 16965; female; age 27 years. Patient had suffered all her life from attacks of tonsillitis. Tonsillectomy under ether in the horizontal position three weeks before entrance. Uneventful convalescence for a week after which she suffered from "malaise and weakness." Headache for one week. Four days before entrance, or 17 days after tonsillectomy, she experienced a chill with temperature of 104°. Two days later, cough. Sputum with foul odor and taste. Pain in left side, worse on deep inspiration. Examination showed impaired resonance at the left base with increased breath sounds and râles. By x-ray a very distinct lung abscess could be demonstrated in the left lower lobe. (Fig. 3.)

Sputum, 110 c.c. a day, was rapidly diminished by postural treatment and inhalations. Within three weeks all trace of abscess had disappeared both by physical examination and x-ray (Fig. 4). She has since married, has passed through a pregnancy and is now well, a year later.

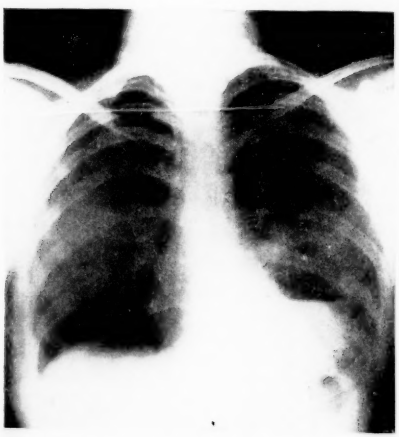

Fig. 3.—Case 5. (A. G. F., Med. 16965.) Post-tonsillectomy abscess in left lower lobe. Note fluid level and very moderate reaction about the abscess. Recovery without operation. (See Fig. 4.)

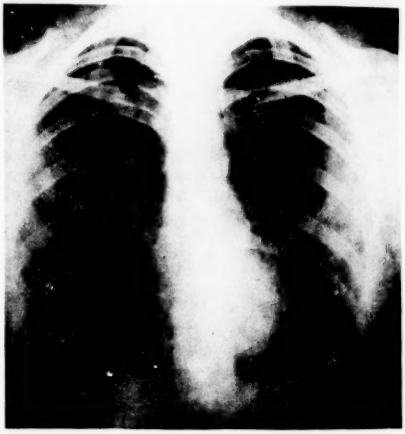

Fig. 4.—Case 5. (A. G. F., Med. 16965.) Plate taken 1 month after Fig. 3. No evidence of abscess remains.

This case is one of typical onset but of very mild character. Cure was spontaneous, rapid and complete. One similar instance of spontaneous recovery following post-tonsillectomy abscess has occurred in this series. The following case illustrates an abscess of similar origin but of a very different course.

Case 6. I. D. R.; Medical 14848, Surgical 14548; female; age 19 years. As a child both tonsils and adenoids were removed. Eight months before the tonsillectomy which occasioned the abscess, the patient was in bed for three weeks with severe tonsillitis. November 10, 1920, tonsillectomy. Ether. Horizontal position. Discharged from hospital the following day. Four days later severe postoperative hemorrhage. Ten days after tonsillectomy she developed a hacking dry cough and pain in the left upper back, with fever. Two weeks after tonsillectomy, when she entered the Brigham Hospital, she presented the picture of fully developed abscess of the lung—fever, pallor, moist skin, leucocytosis, foul breath and sputum (200 c.c. daily). Dulness, râles, increased whispered and spoken voice in the upper left back were

evident. The x-ray disclosed an abscess in the upper left lobe (Fig. 5). Operation was not

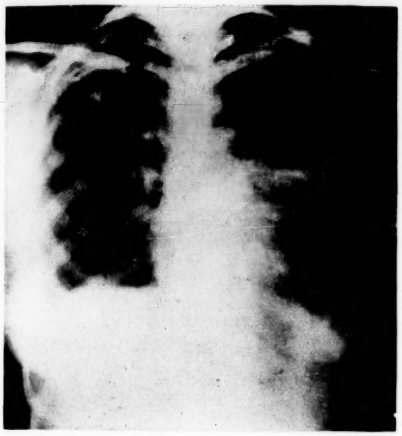

FIG. 5.—Case 6. (I. D. R., Surg. 14548.) Post-tonsillectomy abscess in left upper lobe. Note fluid level and moderate infiltration about the abscess. (See Fig. 6.)

urged, and during several weeks in the hospital the patient improved. At her second admission, three months after tonsillectomy, her condition was unchanged. Operation was advised and refused. Six months after tonsillectomy the patient returned, distinctly the worse in every way. The x-ray now failed to show the abscess, which was evidently masked by a diffuse infiltration of the whole left lung (Fig. 6). Operation,

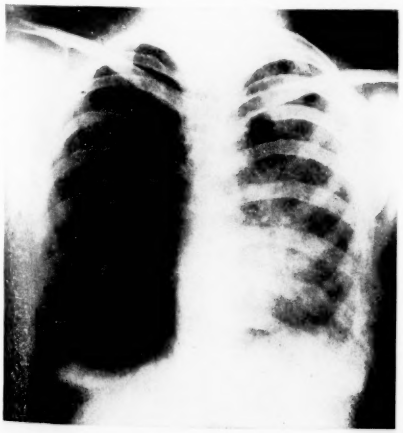

FIG. 6.—Case 6. (I. D. R., Surg. 14548.) Plate taken 6 months later than Fig. 5. Note diffuse infiltration of left lung. Cavity no longer visible, but was found at operation at the spot indicated in Fig. 5.

May 21, 1921, in two stages, under novocain, with some gas-oxygen. Abscess found and drained through a rib resection in the left axilla. Slow convalescence. Wound healed and expectoration ceased in several months. The patient grew fat and appeared well, but within a year several moderate hemorrhages from the lung occurred. One tubercle bacillus was found in the sputum but there were no corresponding signs in the lungs and the general condition was excellent. At present, a year and half after operation, the patient is a picture of health. The x-ray shows some pleural thickening. No trace of the abscess is seen and no evidence of tuberculosis.

This case illustrates again the favorable type of abscess so often seen after tonsillectomy. The delay in operating, however, undoubtedly encouraged a spreading of infection within the diseased lung, postponed healing after operation and left the lung to some extent crippled. In the previous case, early operation, as judged by the result, was not indicated. In this case, on the contrary, operation was too long delayed. Evidently the decision when to operate is not easy to make.

## TREATMENT.

The problem of treating lung abscess becomes very much simplified if we admit, as a study of etiology has already suggested, that postoperative abscess is a less serious disease than that which arises from other causes. The point has been made by many other writers.

In this series, 13 lung abscesses were postoperative. Of these postoperative abscesses, seven recovered with or without operation and five were not cured. Of the abscesses which arose from pneumonia and various other causes, three recovered and six were not cured. One post-tonsillectomy abscess is too recent to count. One postpneumonic abscess cannot be traced.

For the sake of simplicity in this discussion, recovery is taken to mean that the patient is well; failure to cure, that the patient has died or is not well. Thus, the percentage of success in treating postoperative abscess is 58.3% and the percentage of failure 41.7%, while the percentage of success in treating abscess of other origin is 33.3%, and the percentage of failure 67.7%. Evidently postoperative abscess is the less serious disease.

*Treatment of Postoperative Abscess.*—Of the 12 patients in whom the results of treatment of this type of abscess are known, two were not operated upon and both recovered; 100% success for medical treatment! Nevertheless nonoperative treatment, advised by the surgeon or insisted on by the patient in two other instances, resulted in such deterioration of the patient that one, Case 3, died of the disease several years after operation, and the cure of the other was much delayed. It has not appeared, however,

that in the general run of post-tonsillectomy abscess a delay of several months after the disease has become established is necessarily prejudicial to cure. For among the successful operative cases, there was a delay of six months in one, four and one-half months in another, and three months in a third. Indeed, a delay is often quite clearly of advantage in the case of a very sick toxic patient, who in the acute stage would evidently succumb to any operative procedure whatever.*

If there were no other indications for treatment, the results in this series would indicate: that every patient seen within the first few weeks of the establishment of an abscess should be treated along the lines advised by Lockwood, that is, postural drainage, the best food, hygienic surroundings and antiseptic inhalations; that this treatment should be pursued so long as the general condition continues to improve, and so long as the signs in the lung, as shown by physical examination and x-ray study, are retrogressing; but that the patient should be under close observation to detect a change for the worse or cessation of progress. The results indicate, moreover, that operation is likely to be fatal in very sick patients. In other words, if conservative treatment will not tide a patient over the acute stage of the disease, operation is not likely to do so. And, finally, it is highly probable that when an abscess becomes chronic under conservative treatment operative drainage is the only measure likely to prove curative.

A study of a number of x-ray plates of lung abscesses seems to confirm these indications. It will be noted that in the first plate shown (Fig. 1) the abscess is well outlined with a moderate degree of infiltration about it. In Cases 5 and 6 (Figs. 3 and 5) the abscess is of the same character, but in Case 6 the whole left lung became infiltrated in the course of time, Fig. 6 indicating an unfavorable change as compared with Fig. 5. In general, however, the exact appearance of the abscess itself and of the surrounding lung seems to have little prognostic significance. Fig. 7 (F. L. G., Surg. 17039) represents a post-tonsillectomy abscess still under

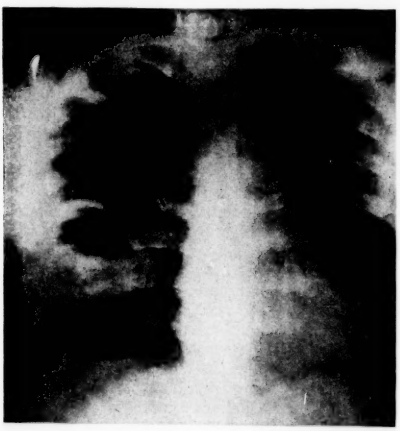

Fig. 7.—(F. L. G., Surg. 17039.) Post-tonsillectomy abscess in right lower lobe 6 weeks after onset. (See Fig. 8.)

*It is perhaps premature to speak of the assistance which bronchoscopic treatment may render during this period. But the few accounts of this treatment already published by Lynah and others indicate that while access to the abscess itself by the bronchial route is unlikely, drainage may be considerably improved and cure of the abscess without operation encouraged.

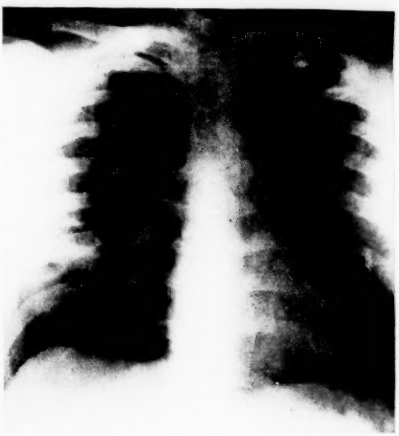

Fig. 8.—(F. L. G., Surg. 17039.) Plate taken 6 weeks later than Fig. 7. Note collapse of abscess and division into two pockets under conservative treatment.

Fig. 9.—(M. H., Surg. 11158.) Large abscess in right upper lobe. The cavity itself is not visible in the plate, but a large abscess was found at operation. Considerable area of gangrene confined to upper lobe. Fatality.

treatment at six weeks after onset. Fig. 8 represents the same abscess six weeks later when the patient's acute symptoms had subsided. The abscess had collapsed and become divided into two pockets.

*The Treatment of Lung Abscess of Other Than Postoperative Origin.*—There remain to be considered the abscesses originating in pneumonia, from inhalation of poisonous or irritating substances and those in which no etiologic factor is known. These cases are far more dangerous than the postoperative variety and they have proved more difficult of cure. Wherever gangrene of any consequence has been associated with the abscess the result has been fatal, and operation has evidently hastened the patient's death. Such a condition is shown in Fig. 9 (M. H., Surg. 11158). The patient had evidently suffered from emphysema and bronchitis. Operation disclosed a large abscess surrounded by a considerable area of gangrene. The patient died in eight weeks. Probably the same general rule of treatment applies as in the postoperative abscesses. Operation during the acute stage in septic patients is usually fatal.

The x-ray shows fewer clean-cut abscesses and more diffuse clouding of the lung than is the case with abscesses of the postoperative type. Fig. 10 (L. DeC., Surg. 12285) represents a

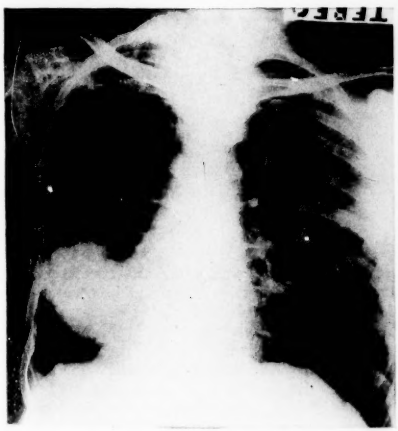

Fig. 10.—(L. DeC., Surg. 12285.) Abscess in left lower lobe associated with substernal goiter. Cavity is not visible but was found at operation. Drainage failed to relieve the patient completely.

process of this sort, an abscess associated with a substernal goiter. The process may have been to some extent a bronchiectasis. The patient has been only partly relieved by drainage. Fig. 11 (W. H. G., Surg. 6997) shows a peculiarly shaped abscess which followed exposure to poisonous fumes at a fire. The abscess was situated in the lower right lobe and was drained

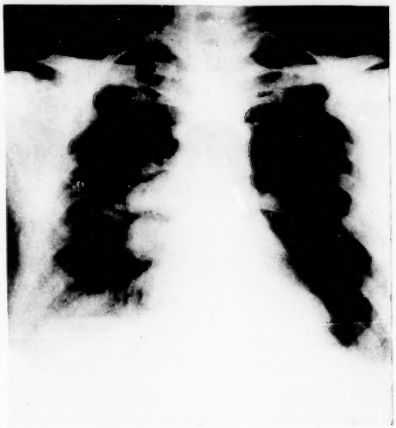

Fig. 11.—(W. H. G., Surg. 6997.) Abscess of the right lower lobe following exposure to fumes at a fire. Drainage was followed by extension of the abscess. (See Fig. 12.)

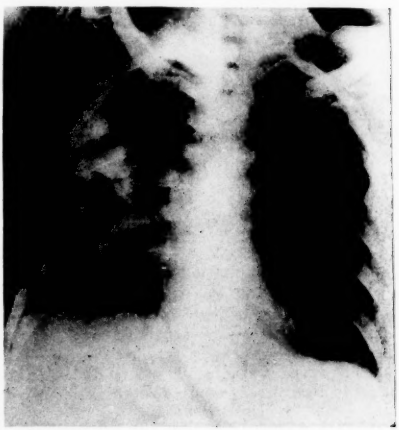

Fig. 12.—(W. H. G., Surg. 6997.) Extension of abscess shown in Fig. 11 to right upper lobe. Drainage was followed by cure.

through the back. Fig. 12 (W. H. G., Surg. 6997) shows a second abscess which developed subsequently in the same patient. It was located in the right upper lobe and was successfully drained. This patient has considered himself well since the healing of his wounds, but coughs at times and is subject to severe bronchitis. It is this type of abscess which Lilienthal[16] properly maintains is seldom or never cured by drainage, but rather, when the chronicity of the disease and the age of the patient permits, by lobectomy.

*Operative Technic.*—A painstaking study of stereoscopic x-ray plates and of physical signs permits remarkably accurate localization of abscess of the lung. And the ease with which the ribs can be resected under a local anesthetic takes the operator to the pleura over the region of the abscess with little disturbance of the patient. Owing to the frequency with which the lesion is found close to the surface of the lung, the pleura is usually adherent. Thus, the lung can be explored for abscess with little danger of pleural infection. Puncture of the chest wall with a sharp needle never need and never should be used. When the pleura is exposed and the lung found adherent, the abscess is most easily found (if its location is not at once apparent) by passing into the lung before a fluoroscope a blunt needle, such as Cushing uses for ventricular puncture. Or if the fluoroscope is not available, a short blunt needle or wire may be passed in at a guess and held in place by packing while stereoscopic plates are taken and studied. Even a small abscess can easily be found in this way, and when found may be entered by a blunt instrument, explored with the finger and drained with a soft tube. The rare deep-seated abscesses are not so hard to find as they are difficult to drain, for if the lung about them is considerably scarred, it is difficult to enter except by incision with a knife, a procedure which must be considered, as regards hemorrhage, a pure gamble. Once the abscess has been entered, cauterization of the track leading to it stops bleeding and keeps the tissues from healing too soon.

When the lung is not adherent, operators differ as to the proper course to follow. The procedure of fearlessly making a pneumothorax and examining the lung with the fingers is not perhaps objectionable in the milder and more chronic cases, but where the balance between life and death is fairly even, it would seem that such disturbance of the pus-soaked and partly gangrenous tissue is likely to spread rather than limit infection. On two occasions in this series the lung was found to be free. In one of these there was a pleural effusion and no attempt was made to secure adhesion. The patient died in nine days. Evidently a bolder treatment could have done no worse. In the second case, the external surface of the thin transparent pleura was wiped with iodine and packed with gauze, but the lung was again found free some two weeks later. As the patient was making excellent progress it was decided to make no further attack upon the abscess but keep him under observation, with the expectation that he would probably recover without drainage. The lung might have been sewed to the pleura, but when a patient coughs as violently as did this one, it is hard to believe that unnecessary damage will not be done to the tissues.

Undoubtedly the procedure to be used when the lung and pleura are not adherent will depend upon the patient's condition and the local relations of the abscess. It would appear that artificial pneumothorax has a definite place here. In the treatment of the general run of abscesses pleural adhesion must render an attempt to collapse the lung more or less ineffectual, but where a free pleural cavity is demonstrated pneumothorax deserves more of a trial than hitherto. Goldberg and Biesenthal[17] report three successes in the early cases. They state that in other cases (they fail to say how many) they failed to secure collapse because of adhesions. Tewksbury[18] also reports a number of successes. But none of these observers seems to have followed his patients for more than a few months.

*The Prevention of Lung Abscess.*—If abscess of the lung is, as it appears to be, a complication of pulmonary inflammation in which the accidental presence of liquefying bacteria leads to a destruction of tissue, it is difficult to see how, in the presence of pneumonia, especially broncho-pneumonia, it can be prevented from occurring with its usual incidence. But as a postoperative complication it can undoubtedly be checked, for the same precautions which are taken against any postoperative pulmonary complication apply to it. In almost all the patients of this series who suffered from postoperative abscess, there is evidence of the presence in the tonsils or teeth of suppurative bacterial infection, and most, if not all, were operated upon under ether. Even if one leaves aside the possibility of gross aspiration of septic material there is no doubt that ether anesthesia lowers the resistance of the lungs to infection, not only by its local irritant action but by its effect on the body in general. And whether the pyogenic bacteria reach the lungs by the air passages, by the blood stream or by the lymphatics, the combination of bacteria and lowered resistance leads to postoperative bronchitis, pneumonia and abscess. In one instance in this series, a healthy girl was left for hours after an ether tonsillectomy in a bed wet by a leaking hot water bottle. Ether anesthesia adds to the dangers of tonsillectomy in association with accidents of this kind. In fact, tonsillectomy under ether is altogether too freely and thoughtlessly performed. If it were limited to such operations as can be carried out under a local anesthetic (there would still be a small morbidity) fewer unnecessary tonsillectomies would be made and lung abscess would be far less frequent. In the same way tooth extraction under ether is dangerous. The instance in this series of the removal of a large number of teeth from an obviously toxic patient is a case in point.

We shall probably go farther toward preventing postoperative lung abscess by doing away with obvious sources of infection having access to the pulmonary area, and by avoiding forms of anesthesia which lower the resistance of the lungs when such infection is inevitably present,

than by depending solely upon the prevention of aspiration by refinements of technic. Precautions against inhalation of septic material should by all means be taken, but common sense measures against lowering the resistance of the lungs to infection should always come first.

### CONCLUSIONS.

1. The distribution of abscesses of the lung among the pulmonary lobes is similar to that of other acute pulmonary infections.

2. The right lung, and especially the right lower lobe, is chiefly involved, whether the process is abscess, pneumonia or embolism.

3. This preponderance of right lobe disease is due to some extent to the greater size of the right lung, but more to the greater exposure to wear and tear of the right bronchial tree.

4. Postoperative abscesses, particularly those which follow operations on the tonsils and teeth, occur more often in the upper lobes and less often in the lower lobes than do other pulmonary infections.

5. This tendency suggests that immediate aspiration from the mouth and throat is less of an etiologic factor than has generally been believed.

6. Postoperative abscesses are not infrequently cured by postural drainage and general hygienic measures. They should not be subjected to operation until it is demonstrated under close observation that cure by nonoperative means is unlikely.

7. The precautions which should be taken against the occurrence of postoperative abscess should include not only those usually employed against inhalation (the abolition of ether anesthesia for tonsillectomy or tooth extraction when infection is present in the mouth and throat), but the same precautions against lowering the resistance of the patient which are employed to prevent the occurrence of postoperative bronchitis and pneumonia.

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## THE CLINICAL IMPORTANCE OF THE CHRONIC CHANGES IN THE APPENDIX WHICH ARE DISCOVERED BY THE ROENTGEN RAY.*

BY FRANKLIN W. WHITE, M.D., BOSTON.

*Instructor in Medicine, Harvard University; Visiting Physician, Boston City Hospital.*

"Chronic appendicitis" is a diagnosis which is very common and rather loosely applied by the clinician, the surgeon and the radiologist. The symptoms are not clean cut, the surgical findings are very variable, and the x-ray findings equally so. There is a common impression that almost every adult has some chronic changes in the appendix, and therefore we can make the diagnosis very frequently, and be backed up at operation or by the pathologist. The question resolves itself into two parts: First, what are the signs of chronic changes in the appendix? Second, how important are they to the individual?

We may say that the radiologist is only concerned with the diagnosis. Let him make a record of the facts and hand them to the family doctor. Theoretically, the x-ray data must be taken with the clinical data to decide the diagnosis and treatment. Practically, the radiologist has a heavy responsibility in making the diagnosis and in talking to the family doctor about it. Consciously or unconsciously, what he says carries great weight. He shows pictures, clear graphic evidence, which is apt to be overemphasized. Many times merely to mention or suggest "a chronic appendix" is equivalent to saying to the family doctor, "Take it out at once." No other organ is so frequently removed without cause. On this account we must discuss not only the first question, the diagnosis, the signs of chronic appendicitis, but also the second question, how important they are to the individual patient. In fact, the second question is more important at present than the first. The signs of chronic changes in the appendix are well known. I have no new sign to offer. My only excuse for taking them up here is because there has been such a wide difference of opinion on details in the past. It is well to discuss them briefly and get together on essentials.

*Pathology.*—Chronic appendicitis is a poor

*Read before the New England Roentgen Ray Society, January 14, 1922.

term. There are practically no chronic inflammations in the appendix, with the rare exception of tuberculosis. There are chronic changes, the result of recurrent previous inflammation which may cause chronic functional disturbance. In acute inflammation, we have necrosis, ulceration, which leaves scar tissue, fibrosis and peritoneal adhesions; the interstitial tissue contracts, the mucosa is destroyed, and we have obliterative changes. The connective tissue in the appendix, the slow progressive fibrosis may lead to marked changes in form without symptoms, especially in old people, and the condition was formerly first discovered at operation or autopsy. Now it is frequently discovered by the x-ray. The connective tissue in adhesions is often a cause of symptoms but often is not.

*X-Ray Signs.*—Direct signs in the appendix are tenderness, fixation, kinking, changes of shape, abnormal position, lack of filling, slow emptying, beading, also adhesions in the ileocecal region. The indirect signs are pylorie spasm, gastric residues and ileal stasis. The signs themselves are quite clean cut and easily understood. Their interpretation requires exact knowledge of the anatomy and physiology of the bowel. Most of the signs are suggestive rather than definite, and several, the more the better, are needed for a diagnosis (taken, of course, with the clinical evidence). If there is no tenderness and no fixation, the other signs count for little. Up to a few years ago there was the greatest divergence of opinion on the significance of signs such as the filling and emptying of the appendix, ileal stasis, etc. Now with steadily increasing experience, opinions are becoming more standard and uniform.

*Time and Position for Examination.*—The x-ray examination of the appendix is usually a part of a complete gastro-intestinal examination and is done at the usual intervals of six and 24 hours, and later, if necessary. At six hours, when the barium meal is scattered in the coils of the ileum, it is not so easy to see the appendix. If an examination is made for the appendix alone, the ideal time is 12 hours and upward. The examination must be extended as long as 24 or 48 hours or more, not only because the appendix is often more easily seen, but also to note delay in emptying due to mechanical interference. The best position for fluoroscopic examination is with the patient lying on the back, as for the usual abdominal palpation. Special positions are rarely needed. The use of the fluoroscope is very valuable, in order to get down into the right lower quadrant and palpate the appendix to see if it is tender, and to get a good view of it by pushing the cecum and ileum out of the way, and to detect and judge the extent of adhesions.

DIRECT SIGNS.

*Tenderness* is not strictly a Roentgen sign; the value of the x-ray is in sharply localizing it and attaching it to some organ because we see the organ when we palpate it. Constant tenderness over the appendix (and not elsewhere) or on trying to move it is the best single sign of pathology. Most normal appendices are not sensitive and can be pushed about quite freely, depending on the length of the mesentery. Tenderness over the appendix when seen with the fluoroscope is far better than tenderness over McBurney's point on physical examination, which may be far from the appendix, even five or six inches or more. In some other conditions, for example sacro-iliac strain, the tenderness may remain fixed, may be in the same spot in both erect and horizontal positions while the appendix moves about freely with change of position, and has no relation to the tender spot.

The full, heavy cecum in atony and ptosis is often tender, and we must not stress this tenderness too much unless the appendix itself is seen. If we find a tender cecum in a ptosis case and no appendix visible, we must not hastily conclude that the tenderness is due to a retrocecal appendix. These ptosis cases cause most of the mistakes in diagnosis and are most often operated upon needlessly. Tenderness is a very important sign, one of the most important, but it is subjective, and it should not be the main support of the diagnosis, but should be taken, if possible, with other signs, such as changes of form, adhesions, etc.

*Filling.*—The filling of the appendix is important, but expert opinion varies greatly from George,[1] who says that an appendix which does not fill is pathological, to Skinner,[2] who says that an adult appendix which does fill is pathological. These two extremes mean that an appendix, according to George, which does not fill has an obliterated lumen, and is therefore wrong; or according to Skinner that the appendix is the "abdominal tonsil," a lymphoid structure, that it should normally and properly obliterate and keep out barium, and if it does not obliterate it is wrong. We must not be misled here; nearly all pathologists agree that obliteration is a sign of disease (Fig. 8), that it occurs after repeated inflammations and deposits of scar tissue, and is not simply the disappearance of the lymphoid tissue of the growing animal.

I do not care to make the diagnosis of an obliterated or retrocecal appendix simply because it cannot be seen, for I believe many other appendices may not happen to be filled at the time of examination. Cohen[3] says the appendix may fill and empty several times during the passage of the same opaque meal, which is one reason why it is not always seen. We have found the appendix filled in more than one-half our cases. When seen, it can be studied and diagnosed; when not seen, little can be said about it. When an appendix is faintly outlined it may be due to partial filling with barium, not to obliteration of the appendix. The appendix is like the rest

FIG. 3.—Typical obliterative changes. Appendix very narrow, mobile, not tender. No operation; no symptoms two years after x-ray examination.

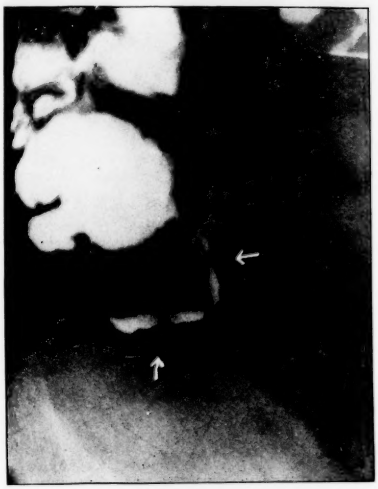

FIG. 4.—Appendix shows some fixation, angulation and beading, not tender. No operation; no symptoms for five years after x-ray examination.

of the colon, and partial filling of one portion after a barium meal may be only accidental and temporary; not due to narrowing.

The kind of barium meal is worth mention. Some say that the buttermilk meal fills the appendix more frequently than the starch meal. I have used a starch gruel routine, and comparison in occasional cases with buttermilk has given the same results. George[1] with a buttermilk meal gets 70 per cent. filling, and Ström[4] in a recent paper, with potato gruel, reports over 70 per cent. filling. The variation in figures from 40 to 70 per cent. given by different men probably represents more the degree of intensive study and care in examination than the different quality of the meals.

The filling of the appendix may be irregular, interrupted, beaded, or segmental, or show fecal masses.

Simple segmentation or beading of the contents of the appendix deserves a word (Figs. 4 and 5). It has been commonly mentioned in the past as a sign of disease in almost every paper read. What is it due to? We can only tell by physiological comparisons, by repeated examinations of the same case to show its constancy, and by comparisons with appendices at operation or autopsy. Peristaltic waves go into and come out of the appendix in the lower animals, and in man to some extent. This segmentation or separation of contents may be due to tonic contraction rings, such as are found in the colon of the rabbit and dog. Haustration is the rule in the colon in man; why may it not extend to the appendix? On the other hand, the beading may be due simply to the absorption of water and drying out of the contents of the appendix and separation of the barium meal into segments. No such anatomical change in the appendix is ever found at operation or autopsy; the process is probably purely physiological.

FIG. 5.—Appendix shows typical "beading," some fixation, not tender. No operation; no symptoms two and one-half years after x-ray examination.

Filling around fecal masses in the appendix which show as oval light spots, like peas in a pod, is often suggestive of disease. They can be found in almost anyone, but they are found most often and most markedly in appendices which do not empty well, and where the feces have dried up into little scybala. Such badly draining appendices often cause trouble.

*Emptying.*—The normal appendix empties in 24 to 36 hours or more. There is probably a large normal variation up to a day or two, such as occurs in the rest of the colon. We are suspicious of poor drainage if the appendix remains filled much over 36 hours or after the cecum has emptied (Figs. 1 and 2). Slow

Fig. 1.—Beaded, bulbous, tender appendix: remains filled after cecum has largely emptied. Appendectomy.

emptying is not an important sign unless accompanied by others, such as tenderness or changes in shape; or unless marked, two days or more. Adhesions may cause delay in emptying the cecum, but usually do not.

*Fixation* is important, especially if it involves one part of the appendix, the tip or median part, and causes kinking and deformity (Fig. 2); this shows adhesions from previous inflammation. Mere bending of the appendix has no diagnostic value, for the appendix, like other parts of the digestive tract, varies greatly in contour and position within 24 hours. Fixation or kinking must be permanent, and not merely apparent or accidental to have any value in diagnosis. We must remember that there is considerable variety in the length of the mesentery of the appendix, and like the cecum some normal ones are freely mobile, while some are rather fixed. Adhesions naturally may involve also

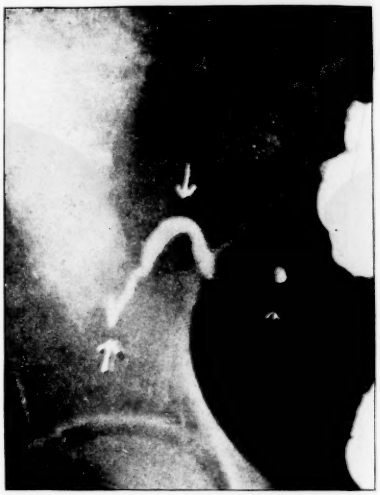

Fig. 2.—Fixed, irregular, tender appendix: lumen narrowed at base; remains filled after cecum is emptied. Appendectomy.

the cecum, ascending colon, transverse colon, ileum and pelvic organs, and cause fixation and deformity.

*Changes in Shape.*—Kinking and angulation are usually due to adhesions, narrowing, scar tissue and obliterative changes (Figs. 4 and 7); irregular dilatation may be due to obstruction

Fig. 7.—Appendix curled up, beaded, moderately tender. No operation; no symptoms one and one-half years after x-ray examination (operation was expected in this case).

with delay in emptying and fermentation of contents (Fig. 1). Simply large size is not dilatation; the appendix varies in diameter like the cecum and colon, as a result of muscular tone and personal peculiarity. There is so much change of form due to different positions and conditions of filling of the appendix that any change of form must be constant to have any diagnostic value as to the existence of stenosis, kinks, etc.

*Position.*—This depends on the position of the cecum, which may be high above the crest of the ileum, or deep in the pelvis, or in the median line, or even far to the left; little was known about this before the days of the x-ray. The position of the appendix is partly accidental; it is easily pushed about by palpation, or by the pressure of other organs, and is quite variable in the same case at different times if the appendix is free. The appendix is often near McBurney's point, but it is often far from it, five or six inches or more. The clinician should remember this; the radiologist knows it well. The appendix may be retrocecal, and not seen till the cecum is empty, or it may be very obviously out of place, and fixed, bending upward toward the liver (Fig. 6) or behind or outside

Fig. 6.—Appendix shows barium filling around fecal masses, "like peas in a pod;" tip fixed, narrowing of base, not tender. No operation; no symptoms three years after x-ray examination.

the cecum (Fig. 3). Appendices so placed are usually diseased.

INDIRECT SIGNS.

*Ileal Stasis.*—Slow emptying of the ileum with residues of the barium meal, 12 to 24 hours

Fig. 3.—Appendix points upward behind cecum, with tip above crest of ileum; tender. Appendectomy.

or more, is the result of obstructive delay from adhesions. There are other reasons, however, for such delay. Let me illustrate: In the x-ray report of a given case I find "considerable delay in emptying the ileum, no barium has reached the colon in six hours, considerable residue in the ileum at the end of 12 hours; diagnosis, probable adhesions in the ileocecal region, question of chronic appendicitis." I find that the patient is an old lady of 70, who does not empty the ileum very well, neither would she run a mile very well. Emptying the ileum is a muscular effort. It depends on the muscular power and tone of the intestine. Delay here is due to ptosis and atony of the bowel, it is not obstructive, there is no question of appendicitis. In weak, sick, or old people there is often delay all along the line, the stomach, ileum and colon. Don't stress ileal stasis in such cases as these; in the atonic, ptotic cases are made most of the mistaken diagnoses, and most appendices taken out needlessly. The picture is iliac stasis, low, full, tender, slow-emptying cecum, sensitive nerves, pain or distress in the right iliac region; the diagnosis of chronic appendicitis is made; out comes the appendix, and the patient is no better. Sometimes there is a low-grade inflammatory process in the appendix which also involves the terminal ileum, cecum and ascending colon, and there is little or no use in cutting off the appendix; in fact, the adhesions after operation, with slower emptying of the right half of the colon, may make the patient even worse than before.

*Gastric Signs* are spasm of the pylorus and

duodenum with six-hour stomach residues after a barium meal. Spasm of the pyloric region occasionally occurs in "chronic appendicitis," but the spasm is variable and uncertain, and has little constant effect on function. In 100 cases published by the author[5] five years ago with chronic changes about appendix, one-half with adhesions in the ileocecal region and almost one-half (42 per cent.) with ileal stasis of 12 hours or more, only seven showed delay in emptying the stomach. Alvarez compares the intestine to a railroad under the block system where delay low down the line regularly holds up food for several blocks above. This is not always true; an irritating lesion in the lower bowel may or may not slow the progress of food coming toward it from above; depending on the character and degree of the irritation. Our clinical observation and experimental work in cats and men just referred to, all pointed definitely one way, showing, first, that delay in emptying the stomach is the exception, not the rule, in lesions of the lower bowel, and, second, that a strong stimulus is needed from the lower bowel to slow the stomach. In short, pyloric and duodenal spasm and gastric residues are not good diagnostic signs of chronic changes in the appendix. They are only occasionally met with, say once in 12 to 15 cases.

*Incompetent Ileocecal Sphincter* has little relation to the appendix, and is too common in the absence of chronic appendicitis to have any diagnostic value.

*Adhesions* involving the ileum, colon and pelvic organs indicate congenital veils or local inflammation of any kind; previous appendicitis is a common cause.

Lantern slides were shown illustrating x-ray signs, such as fixation, kinking, beading, changes in shape, abnormal position, lack of filling, slow emptying, and how often the appendix was far from McBurney's point. Some of the cases with these signs had been operated upon. In another series showing definite chronic changes, the appendix had been left in the abdomen for periods of one to four years after the x-ray examination, and the patients have remained well.

### CLINICAL IMPORTANCE OF THE SIGNS.

Are there any normal appendices in adults? I have read more than once that "pathologists teach us there are no normal appendices." Dr. F. B. Mallory, the pathologist at the Boston City Hospital, tells me that practically all the appendices taken out at operation for acute or chronic appendicitis at the hospital are pathological. Is this simply the kind-hearted pathologist backing up the surgeon, or does it mean that appendicitis is so common that all adult appendices are more or less pathological, and no matter what you take out you are sure to find a bad one? How many normal appendices are found at autopsy? Dr. Mallory tells me that in routine autopsies in 4000 cases at the Boston City Hospital 95 per cent. of the appendices were normal *in gross*, and showed no adhesions or kinking, no scar tissue or ulceration, no obliterative changes, no constriction, no deformity of shape, not one of the signs which are easily discoverable by the x-ray. Three per cent. showed adhesions, scar tissue or obliterative changes. Two per cent. showed acute inflammation, gangrene or perforation. There were only three concretions in the 4000 cases. In short, when we get x-ray evidence of chronic changes in the appendix they are not universal. They have importance as they are found in only about 5 per cent. of adults.

The x-ray examination of the appendix is a very delicate method and discovers many things about the appendix which were unsuspected, and incidentally many things which may not trouble the patient much, such as poor mobility, small fecal masses, peculiar shapes, chronic obliteration of lumen, "beading," moderate delay in emptying. These were common signs in our group of cases, which were not operated. We have seen these patients going about for one to four years after the x-ray examination with practically no digestive symptoms whatever. The moral is that when these signs are discovered by the x-ray we must not make too much of them, consciously or unconsciously. Many persons will be helped by having a "chronic appendix" removed, many others will get no help at all.

"Chronic appendicitis" is not an entity. The changes vary greatly in degree and kind and in what should be done about them, all the way from the mild, harmless chronic obliterative type to the kinked, bulbous, tender, badly draining type. The atrophic obliterated organ of middle life and beyond usually gives no symptoms and makes no important trouble.

Graphic x-ray evidence is always striking, and makes a great impression, and when the radiologist gives this graphic evidence to the family doctor, it would do no harm to remind him of these things. There is no organ so often removed without cause merely because of some anatomical change. Lahey[6] has recently called attention to the same thing from the surgical end. How often in taking out the appendix in a laparotomy done for other reasons the appendix is found firmly bound by adhesions, so that the x-ray pictures would surely show fixation or poor filling, and yet there is no definite past history of an attack, and no present illness. The wise surgeon will surely hesitate about removing an appendix on x-ray evidence alone without symptoms.

In our operative group we have always found a different group of signs, namely, constant tenderness of the appendix itself, sharp kinks with fixation, marked delay in emptying, with tenderness, or a retrocecal position with tenderness, and in addition the patients have had given a history of local pain or tenderness. The diagnosis has been made chiefly by direct signs in

the appendix itself, or by adhesions. The most important direct signs have been tenderness of the appendix, constant changes in shape, fixation and abnormal position, and the less important have been the filling and emptying of the appendix and signs of fecal residues. "Beading" is often normal.

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## EVENTRATION OF THE DIAPHRAGM.

### Report of a Case with Unusual Findings.

ABRAHAM E. JAFFIN, M.D., JERSEY CITY, N. J.,
AND
JAMES A. HONEIJ, M.D., BOSTON.

In 1853 Henry I. Bowditch of Massachusetts published a very exhaustive monograph on the "Record of a Case of Diaphragmatic Hernia," with a review of as much of the literature as he could find on the subject as far back as 1610. In this study and in the report of his own case he drew no distinction between the various types of these cases, but classed them all under one heading as cases of diaphragmatic hernia. Since his report, many articles have appeared on this subject, and the cases have been reclassified by various writers into several groups according to anatomical findings and etiological factors.

The case forming the subject of this paper illustrates in so many ways the difference and seems so unique that it is considered worth recording. The writer's own error in at first thinking it was a case of diaphragmatic hernia is perhaps the natural one to those not familiar with the other forms of diaphragmatic anomalies. Furthermore a comparison of the findings in this case with those in Bowditch's case proves that they were both the same type of diaphragmatic defect. We will see that neither one was a hernia, but as now regarded—an eventration of the diaphragm.

In a general way we may regard the diaphragm as a tendinous muscular structure separating the thoracic from the abdominal cavity, and as far as our present interest goes, lined above by adherent parietal pleura and below by peritoneum, with several natural openings for the passage of structures between the two. These layers and openings are the important anatomical details in the differentiation of all anomalies of the diaphragm, whether congenital or acquired. As in all other hernias, so in those of the diaphragm, we must recognize a sac made up of one or more of the anatomical structures covering the defect permitting the escape of the underlying organs. When we come to analyze the various cases reported in the past as diaphragmatic hernias, we find that some of them do not conform to this anatomical requirement. These are the cases then that are subject to reclassification under the types known as eviscerations and eventration.

By evisceration it is quite apparent that we mean a very distinct abnormal displacement of one or more organs through the diaphragm regardless of any normal coverings at all. This type is found occurring as a congenital and an acquired form. The former is found in the new-born, either as a partial absence or abnormal opening in the diaphragm, permitting abdominal contents to escape into the thoracic cavity without any of the component layers of the diaphragm as a covering. These infants are usually monsters and have other congenital anomalies that are incompatible with life. This type is therefore not a factor in the differential diagnosis.

The other type is traumatic, or acquired in character, secondary either to a severe external injury tearing the diaphragm or the result of a penetrating wound that involved the latter. This type is also known therefore as a hernia spuria. Cases of this kind have survived with or without repair and may give physical signs that might be confusing in diagnosis.

In eventration, we find a condition quite different anatomically with, as a rule, little in the way of subjective symptoms that would lead to the diagnosis. In 45 cases reported by Bayne-Jones in 1916 (*Archives of Internal Medicine*, Feb., 1916), all were recognized accidentally and with the exception of three were of the left side. Various theories have been advanced by different writers to explain the development of this condition. Essentially we find in these cases that there is no defect in the diaphragm, therefore no real hernia, but rather a diaphragm that is unusually high in the thorax, thin, exerting little or no function excepting as a partition, and that a very feeble one. The only element of defect that can be considered with regard to the diaphragm is that the portion involved, which is usually the entire left half, is uniformly deficient and not in a localized area so as to form a ring through which the abdominal contents may enter the thoracic cavity. The etiology is obscure and the condition is usually associated with other anomalies or defects more or less pronounced, as we shall see in the case here reported. Rheinhold has considered the condition due to a hypoplasia of the lung—this being followed in his opinion by a defective development of that half of the diaphragm. In some

cases however there was found only one lobe to the left lung, but a well developed lobe. Bowditch, in the autopsy report of his case, does not refer to any lack of development of the lung, but describes a compression. From the fact that in these cases the heart is nearly always pushed well over to the right, Crispino regards these as cases of dextro-cardia; but we cannot look upon them as transposed hearts where the dextro-cardia is simply a mechanical lateral displacement, due to the abnormal contents of the left side of the thoracic cavity. One other factor may be mentioned here in pulling the heart to the right and that is the very much greater negative pressure created by the right half of the diaphragm. This results in a shifting of the entire mediastinum to the right, as can be especially well seen with the fluoroscope during inspiration. Two other views that might be mentioned are, that the entire condition is due to a primary defect according to Doehring and that it may possibly be an acquired condition, according to Cruvelhier and Glaser. If acquired, however, as secondary to an early nerve lesion (phrenic) from poliomyelitis, trauma, or an empyema—there would be some obvious etiology.

With this brief attempt to define the cases that are not diaphragmatic hernia, we merely wish to add that we may have a congenital or an acquired diaphragmatic hernia. If in a new-born we find abdominal viscera to have escaped into the chest through a defect in the diaphragm and contained in a sac made up of all but one of the component layers of the diaphragm, we are then dealing with a case of congenital diaphragmatic hernia. These cases are, however, in the great minority and of all the cases usually classed as diaphragmatic hernia 90 per cent. are really traumatic eviscerations or hernia spuria. Soresi has recently called attention (*Annals of Surgery*, March, 1919) to another group of small unrecognized hernia that give misleading abdominal symptoms and could be diagnosed by laparotomy and intra-abdominal exploration only.

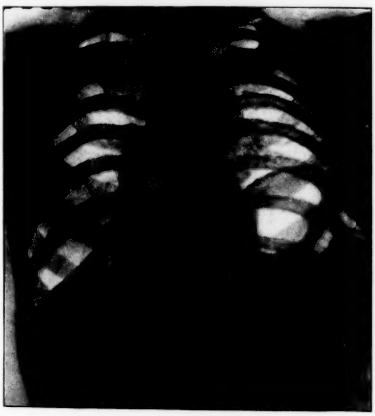
Without this differentiation the entire group of these cases with physical signs so similar, is generally spoken of as diaphragmatic hernia.

We trust that the case here reported will be as interesting to others and as instructive to a better understanding of this clinical group as it was to the writers, so that hereafter the diagnosis will not always be accidental.

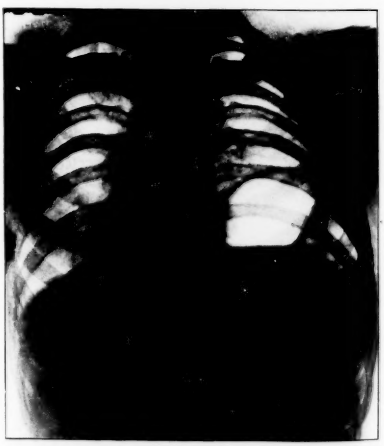
In January, 1919, while on duty at the U. S. Army General Hospital No. 16, at New Haven, the following case came to our notice.

Pvt. A.M.R., farmer, age 25; admitted from Camp Dix, August 31, 1918, with a diagnosis of tuberculosis, inactive, of the left upper lobe. His family history was very suggestive, he having lost his father, one brother, two aunts, and one uncle of tuberculosis.

He had been in the service but a few weeks when he became ill after exposure in rain and was sent to the base hospital with fever, shortness of breath and moderate cough. The following month he expectorated some blood. When admitted to General Hospital No. 16 he had practically no symptoms excepting weakness.



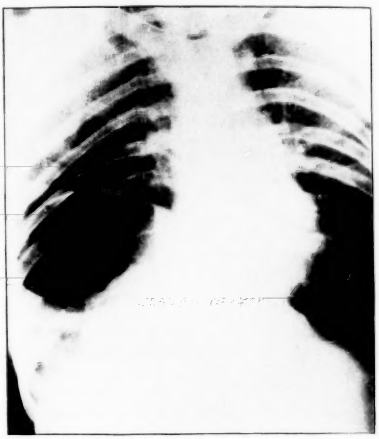
Case No. 827 R. Showing diaphragm outline in 3rd space with empty stomach represented by gas. The interstitial intestinal rings are seen to the right of the stomach.



Same case. Diaphragm outline in 2nd space. Stomach contains fluid, none in intestine to the right of the stomach.

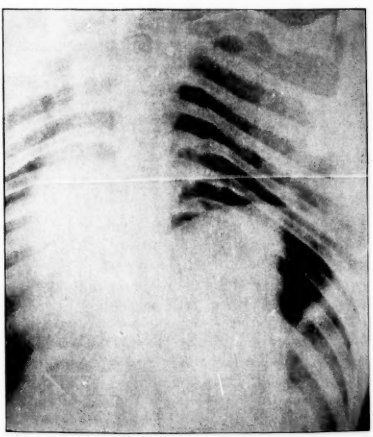
Examination in January at first revealed to the writers signs that were thought to be due possibly to inactive upper lobe lesions on both sides with marked pleural changes at the left

base. While waiting for the radiographic reports the patient was re-examined and a striking difference in signs was discovered. There was tympanitic resonance from the base to the



Same case. Patient is lying down on his side, fluid line of level has changed, intestines displaced below stomach.

second rib, with absence of vocal resonance and breath sounds from the base to the third rib. Over this area many gurgling, musical and tinkling sounds could be heard, some resembling peristaltic noises. Succussion was audible and palpable. The heart was found displaced well to the right. These signs suggested a hydropneumothorax, but in the complete absence of any clinical history that might account for its development, the diagnosis was reserved until the patient could be examined again when the stomach was empty.



Same case. Patient on side again with larger amount of fluid in stomach. Heart more displaced than before when stomach contained only small amount of fluid.

Therefore, the following morning before his breakfast, this was done and there was a noticeable difference in the findings. The splashing that had been heard and felt previously was now absent, though the other signs were in the main unchanged.

However, by giving the patient about 600 c.c. of water to drink the succussion was again obtained.

It seemed evident then that the patient's stomach was displaced abnormally high in the thorax. The conclusion drawn at this time therefore was that we were dealing with a congenital diaphragmatic hernia. This deduction was very soon disproven by the radiological report, which was as follows:

"Considerable peribronchial thickening left upper and throughout right lung; no definite mottling; some apical markings. Slight general increase in density, excepting both bases. Hilus not determined. At left base, third space, there is a curved, thin, opaque line extending from median line to thoracic wall. Below this is marked transparency, and below this is a level line of extreme density which changes with position of patient. With patient placed on side this level line of density is seen parallel to vertebral column, and in space previously occupied by this density are numerous outlines suggesting a colon. Diaphragm on right is low, extending from sixth rib to eighth space on outer side. The heart is dilated and is much displaced to the right. Apex is not discernible in left pulmonary field. Different periods of examination, the amount of density in transparent area previously described varies.

Diagnosis: Congenital deformity and displacement of left diaphragm with adherent and displaced stomach. There is no radiological evidence of pulmonary tuberculosis.

On re-examination the diaphragm is seen to rise on expiration to second space front and seventh space back. On inspiration the diaphragm moves to the third space front and eighth space back. Extreme heart border on left is seen 2 cm. outside the vertebral column margin. Right border extends to nearly the mid-clavicular line. Stomach under all conditions contains considerable gas; so does the colon which lies to the left of the stomach just below the diaphragm.

After barium meal, examination shows the fundus of stomach situated as previously described. Fluid line of level is distinctly seen. The body and pylorie portion is situated on the left side vertically, continuous downward with the fundus, so that whole position of stomach instead of lying transversely across body is vertically suspended from diaphragm. The duo-

denal cap is situated at the left border of the vertebral column."

It is apparent from the anatomical considerations of the above radiographic findings that we are dealing with a condition corresponding to the requirements previously outlined in the definition of an eventration of the diaphragm. The autopsy findings described by Bowditch in his monograph referred to in the beginning are particularly interesting in this connection as they correspond so closely to the observations in the above case.

In further support of the theory of congenital origin might be mentioned several minor abnormalities in this patient. There was a noticeable facial asymmetry due to a greater prominence of the left malar bone and a strikingly increased development of the left trapezius muscle. There was a slight scoliosis from the seventh cervical to the fourth dorsal spines which was probably secondary.

### DIFFERENTIAL DIAGNOSIS.

There are several more or less frequent clinical conditions that might give rise to similar physical signs and that require differentiation.

1. Pneumothorax with fluid:
   (a) Usually preceded by symptoms, acute or chronic.
   (b) No evidence of peristalsis.
   (c) Not influenced by gastric contents, as seen by x-ray or determined by physical examination.
   (d) Cardiac displacement is less marked except in very marked case.
   (e) Upper level of sharp change in physical signs absent, unless there is a partial hydropneumothorax and even then the upper level does not descend at all with inspiration as it does in eventration.
2. Large pulmonary cavity:
   Marked pulmonary symptoms and other evidence of pulmonary damage.
3. Subphrenic abscess with gas:
   Pain, fever, and history of cause and sepsis. Usually right sided, after an attack or operation for appendicitis.
4. Paralysis of diaphragm:
   Usually bilateral, or due to injury or acute thoracic affection.
   Acute poliomyelitis involving the phrenic nerve cannot be completely excluded.
5. Hernia and evisceration:
   (a) History of trauma.
   (b) Compression of lung.
   (c) Radiographic picture usually that of an irregular protrusion through a defect in the diaphragm contrasting with the regular diaphragmatic covering in eventration.
   (d) Usually no evidence of any descent of diaphragm with inspiration.

### EMBRYOLOGY OF THE DIAPHRAGM.

A proper study of eventration depends largely on some knowledge of the local embryology. The diaphragm develops from an invagination of the walls of the fetal layers in what is termed the pars intermedia which is at first a fold that comes in laterally to divide the original single body into two, the thoracic and abdominal. This leads to the formation of the two aerous cavities, the pleural and peritoneal. From the few autopsies on record, notably Bowditch's case, we can study this structural deficiency in the thin hypoplastic sheet that acts as a rudimentary diaphragm. The hypoplastic condition of the lung together with a certain amount of compression seems secondary, and the displacements of more or less of the viscera the mechanical consequence.

Charles Lyman Greene, in his excellent and comprehensive work on "Medical Diagnosis," of 1917, says, in his chapter on Pneumothorax: "Idiopathic unilateral ascent of the diaphragm is so rare as hardly to need consideration in this volume." And yet with modern means of study if we could and would avail ourselves of the advantage of the x-ray in all our cases, would we find it so rare?

We cannot help feeling that it is another one of those conditions that will become more common as our ability to recognize it increases. The literature is already growing on this subject and many more cases may follow the keener study of puzzling physical signs.

## CHRONIC URETHRITIS IN WOMEN.

BY CORINNE RHEA CÔTÉ, M.D.,
AND
GEORGE GILBERT SMITH, M.D., BOSTON.

[From the Genito-Urinary Department, Massachusetts General Hospital.]

THE symptom-complex occurring in women and characterized by frequent and painful urination is found so often to bear no apparent relation to bladder or kidney lesions that its study has been undertaken to determine, if possible, to what extent chronic urethritis may be responsible. By chronic urethritis we refer to a low-grade inflammatory process in the urethra, the pathology of which is probably similar to that found in chronic urethritis in the male. In other words, there are areas of submucous round-cell infiltration, and round-cell invasion of the tissues about those urethral glands which occur in the female urethra as well as in the male. Unfortunately very little is known of the true pathology of this condition. The only real evidence bearing on the situation, so far as we could find, is that put forward by Noguès.[13] In

several cases at autopsy, he found slight changes in the epithelium with infiltration of cells directly beneath; a massing of leucocytes, and, in some cases, areas of necrosis.

The mucous membrane of the urethra is normally thrown into longitudinal folds, and is composed of 3 coats: (a) muscular, which is continuous with that of the bladder; (b) erectile, consisting of a spongy tissue which contains a plexus of large veins intermixed with bundles of unstriped muscle; (c) mucous, pink in color, lined by stratified squamous epithelium, becoming transitional near the bladder, and continuous with the bladder mucous membrane. It is within the second coat that the circulatory changes mentioned by Le Fur[4] take place, *i. e.*, a general sclerosis of the vessels causing a thickening which extends to all the coats. This diminishes the entire urethral caliber in some cases, and in others, causes partial or complete stricture.

Noguès also states that there is a varying degree of infiltration of the urethral tissues. The mucous membrane is oedematous and congested. At times, only red striations are observed; often there are definite areas of beef-like redness. The lesions as a rule are diffuse, but they sometimes become localized at one or two points, having the appearance of small inflammatory tumors, either polypi or granulomata.

When it comes to an understanding of the causative factors in this condition, we are more at sea than we are in regard to the pathology. Many theories have been put forward.

Bizard and Blum[7] believe that urethritis is usually a secondary infection caused by extension from the vagina, and assert that 60% of the acute specific urethritides are followed by the chronic form. Noguès[13] has shown, however, that microörganisms, particularly the B. coli and the enterococcus, have little affinity for the mucous membranes of the urethra. They simply pass through, leaving only superficial lesions. It is rather the repetition of these attacks involving the same tissues, the resistance of which is being lowered progressively, that calls the patient's attention to the condition.

Hunner[2] refers to the "rheumatic" type of urethritis, and states that the chronically infected tonsils are often primarily at fault as a focus of infection. In a later paper,[3] he reiterates his views on this subject. The same author mentions coitus and onanism as etiological factors.

Lavenant[11] has shown that a saprophyte, the enterococcus, having certain characteristics in common with the streptococcus and staphylococcus in that it is found in large numbers on the surface and in the cavities of the body, and being pathogenic only in abnormal conditions, is a frequent agent of secondary infection of the urethra, even primary at times.

Legueu mentions a discharge the action of which on the mucous membrane causes it to lose its natural elasticity, fibrous tissue replacing elastic tissue. Uniform thickening of the entire urethra results and he terms this "fibrous urethritis."

Le Fur[4] has called the condition resulting from circulatory changes in the walls of the urethra due to senility "Chronic Interstitial Urethritis."

Among the various etiological factors observed by Noguès,[13] this symptom-complex is attributed, in some instances, to certain chemical characteristics of the urine such as hyperacidity. The same author believes also that in several of the cases which he has seen, the subjective symptoms are not fully explained by the histological changes. He assumes that the nervous system tends in many cases to exaggerate the condition.

Shallenberger[9] believes that the congestion of menstruation activates the organisms already present and so causes a low-grade inflammatory reaction. Several authors believe that the stretching or rupture of muscle fibers incident to childbirth causes disturbances at the time due to processes of repair, and that later, in middle adult life, this may be responsible for the muscular atony associated with the general body changes.

Undoubtedly all of these factors are operative in one case or another. Sometimes we can trace a relationship, at least in time, between a previous pyelocystitis, for example, and the residual urethritis. In other cases an antecedent specific urethritis leaves a urethra which is the seat of chronic round-cell infiltration. Pelvic congestion due to ptosis or constipation without question aggravates the condition.

The relative importance of this symptom-complex has not been recognized in the literature, although within the last few years more has been written about it. It is, of course, a minor ailment, never directly affecting the health of the individual who suffers from it, yet from the point of view of her comfort and happiness chronic urethritis ranks much higher than many more serious diseases. To be hounded night and day by the imperious demands of an "irritable bladder" is a serious condition, socially and economically speaking. The ability to relieve a woman, often completely, of this cross is a source of eternal satisfaction to doctor and patient, the more so because not infrequently the right treatment will give relief within a few weeks, after months and years of improperly directed treatment has failed.

The condition is frequently diagnosed as "cystitis," "irritable bladder," or "trigonitis." In typical cases the correct diagnosis can be made by the simple manoeuvre of passing a catheter, securing a specimen of urine, and dilating the bladder. If the urine is clear and the sediment shows only an occasional leucocyte, true cystitis can be excluded. A submucous

fibrosis of the bladder—so-called "elusive ulcer"—might be the cause of frequency and pain, and could not be excluded merely because the urine showed no pus. If, however, the bladder will tolerate a distention of 300 c.c., one can, with a considerable degree of certainty, rule out the above condition. This reduces the probable causes of frequency to the condition which we are discussing. One must bear in mind the unusual cases of uninfected vesical calculus, but calculi should be palpable on bimanual examination. Duke[18] has reported cases of bladder allergy, due to the ingestion of certain foods. It may be necessary to consider such a possibility in the differential diagnosis, but at present we do not know enough about it to discuss it intelligently.

With the desire to learn a little more about this condition, particularly as regards its etiology, and to ascertain with what degree of confidence one could institute a course of treatment, we have studied 42 cases of urethritis collected in three months at the Massachusetts General Hospital Genito-Urinary Clinic, and 8 in the private practice of one of us. The condition for which they sought relief had been present for a period of from three months to twenty years, 54% having complained of the symptoms for more than two years. Some had been treated, others not, the treatment consisting of bladder washes, various medications used in genito-urinary infections, and gynecological procedures, including surgical, without relief of symptoms; if anything, each succeeding attack seemed to increase in severity, with progressively greater discomfort between attacks.

It is interesting to note that the majority of cases were patients at or just before the menopausal age, most of whom had borne children, as follows: 20 to 29 years, 12 per cent; 30 to 39 years, 22 per cent; 40 to 49 years, 52 per cent; 50 to 59 years, 8 per cent; 60 on, 6 per cent; 57 per cent had had one or more children.

In process of elimination, the urine was examined, both as to culture and sediments. In 50 per cent of the cases, there was a growth of bacteria, either moderate or profuse, the B-coli predominating. The organism next in evidence was the staphylococcus.

The sediments were not remarkable. We found an occasional leucocyte per h. p. f. in 18 per cent; 5, more or less, in 8 per cent; 10-20, free and in clumps, in 2 per cent; profuse, in 2 per cent, and in 6 per cent many motile colon-like bacilli. There were a variable number of cocci and epithelial cells. There were 41.5 per cent normal as to culture and sediments. Of this group, the hydrogen-ion concentration was determined in 47 per cent of the cases: 66 2-3 per cent varied between 5.4 and 5.9.

We are aware that the criticism will be made that a certain number of our cases had pyelitis, and that the urethritis was purely a secondary manifestation of the urinary infection. It is true that in 4 per cent of our series—that is, in two cases—sufficient pus was found in the sediment to make one suspect a renal infection. This finding was not constant; had it been, we should most certainly have catheterized the ureters. It is not unusual for these cases of urethritis to have hazy urine at some time while under observation. If the pyuria clears up before the next visit, and the patient has no renal symptoms, we do not feel justified in making a diagnosis of pyelitis. We believe that showers of bacteria in the urine do occur, due perhaps to intestinal stasis; these urinary infections are undoubtedly a factor in causing recurrent attacks of urethritis. We have studied several cases of this type with pyelograms and cultures. Between the bacterial invasions, the urine was sterile and pyelograms were normal. There was no pyelitis, either acute or chronic, and no ureteral stricture. Some factor more remote than the kidney must have been responsible for the bacteriuria.

A cystoscopic examination was made in 78 per cent of the cases. In 62 per cent of these, the trigone showed a varied pathology: some showed oedema bullosum, presenting a pebbly appearance; in others there was congestion, and the blood vessels were dilated and tortuous, this appearance involving more or less the entire trigonal area, and in a few cases, the ureteral orifices as well. The bladder walls showed no pathology other than this, and in none was the capacity definitely diminished.

Those gynecological conditions which might have had a direct bearing on increased frequency were present in 32 per cent of the cases as follows: tumor, 4 per cent; vaginal discharge, 12 per cent; cystocele, 12 per cent; retroversion, 4 per cent.

These conditions remained untreated except in the cases of vaginal discharge. Inasmuch as the patients' symptoms were relieved by urethral treatment, it seems justifiable to conclude that the gynecological lesions were not of primary importance as far as the urethral condition was concerned.

The nasopharynx was examined in 42 cases with the following results:

Nasopharynx normal ..... 80%

Chronic hypertrophic tonsillitis ..... 12%

One patient had tonsillectomy performed during treatment of the urethritis. She reported increased severity of urinary symptoms at that time. The other patients in this group were definitely relieved of the urethral symptoms without treatment of the throat condition.

Frequent colds ..... 4%

Tonsillitis frequently until 4 and 6 years before admission to the Clinic, at which time tonsillectomy was done without relief of urinary symptoms at that time.

Chronic infected tonsils from which cheesy secretion was expressed ..... 4%

The commonest symptoms in our series were, in the order named: (1) frequency, true incontinence not being considered; and (2) pain, in or about the bladder, and in some cases, backache. The suprapubic pain was variously described as "itching," "bearing-down between urinations," "smarting," "scalding," "prickling"; some had a sense of pressure after voiding. Two patients said that the discomfort was worse when standing, and one mentioned a "gritty sensation" before the stream was started. Another was relieved "by sitting on the floor pressing the pubes against the hard surface of the floor." The sensations referred to the urethra remind one of the smarting, irritating feelings caused by granular lids. The frequency varied from 30 minutes to 2 hours, and was diurnal rather than nocturnal.

The treatment of urethritis used in this series consisted of: 1, *Dilatation*, followed by instillations of argyrol 15%. Since urethral inflammation results in the narrowing of the lumen, it is necessary to stretch the contracted tissues. Furthermore, the resolution of areas of round-cell infiltration is hastened by dilatation. After determining the urethral caliber in each case, the dilatation was accomplished by gradually increasing the size of the dilator at each visit. Male urethral sounds, Hank's cervical dilators, and later, the Kollmann dilator, were used. The two desired results are slight hyperemia to raise the tone of the mucous membrane, and the evacuation of the urethral glands. Care was taken not to dilate too rapidly or forcefully as this might induce trauma.

In 20% of the cases, this treatment sufficed to give complete relief. In the remaining cases, the findings warranted more drastic treatment. In these we made 2, *Applications of Silver Nitrate 20%*. The French literature states that the more caustic solutions are too irritating and reports greater success with soothing applications such as lanolin and cocoa butter to which has been added argyrol or zinc oxide. But the success we met with in using silver nitrate has been most satisfactory and would not appear to bear out that statement, although we cannot speak comparatively.

After catheterization of the bladder, and with the patient in the knee-chest position, an endoscope, as large as the urethra permitted, was introduced past the internal urethral orifice. The condition of the sphincter was observed, whether tight or relaxed. The mucous membrane of the entire urethra, being thus put on the stretch, was clearly exposed and its condition noted, as the endoscope was moved up and down. A cotton applicator soaked in silver nitrate 20% was then touched to the entire surface, and the endoscope withdrawn.

The reaction to this treatment varies in direct proportion to the degree of inflammation present: the dysuria and the frequency are often increased for one or two days. It often happened that a patient was disinclined to submit to a second treatment because of the burning sensation experienced afterwards. Marked improvement, however, was reported after the second or third treatment. In our series, the treatments numbered from 3 to 17, usually one a week. In practically every case, a clinical cure was obtained. As most of this work was done during the summer of 1922, the question of the permanence of the cure cannot yet be answered. There is one exception to report. This patient was treated for eight months, every week. At the end of that time, all the objective symptoms had disappeared. She still complained of frequency and ardor urinae, as before. A second thorough examination was made including, at this time, the inoculation of a guinea-pig. All the findings were negative. We concluded, as a result, that there must be a strong neuropsychotic element present.

In following the history of cases of chronic urethritis over a period of years, one is impressed by the likelihood of recurrence of the symptoms whenever the patient catches cold, becomes overtired, or otherwise feels below normal. Those factors which caused the trouble originally will cause it again, unless they are removed. Recurrent attacks, however, usually clear up more rapidly than does the attack first treated. The possibility of recurrence makes it advisable to correct, as far as possible, the faulty habits or the anatomical abnormalities which may be indirectly responsible for the urethritis. Constipation and ptosis are particularly to be fought against. In fact, not infrequently an entire change in the patient's mode of life, in her diet and in her habits, may be necessary to insure against a recurrence of her urethritis.

A few specimen cases are appended.

Case 4. Age 39, para-4. Itching and burning at external urethral orifice with slight purulent discharge from the urethra. Frequency with pain before urination. Duration was of three years, during which time she had been treated for endocervicitis because symptoms mentioned at onset were "pain in the lower abdomen," and "swelling about vulva." *Examination:* Second degree retroversion. Endocervicitis (the gonococcus was never found). Cystoscopy showed a moderately injected trigone. Ureteral orifices and bladder mucosa normal. Urine, few staphylococci in groups, leucocytes 3-5 in h. p. f. Moderate number long bacilli. Urethral mucosa was moderately red and granular in proximal third. Bled easily. Dilatation and application of silver nitrate 20% to trigone and urethra, eight treatments in all, covering a period of three months. Discharged well.

CASE 17. Age 38, para-1. Urgency and dribbling. Present trouble dated back two years. Six years before had had incontinence for one year, relieved for four years by right salpingo-oöphorectomy and appendectomy. *Examination:* Third degree retroversion. Bladder normal except for injection of blood vessels about trigone. Urine negative; Ph 5.9. Urethra very red, middle third markedly so, at which point there was a slight narrowing of the lumen. Eleven treatments were given, alternating dilatation with applications of silver nitrate 20%, with an occasional bladder wash of silver nitrate 1:5000. In four and one-half months, discharged entirely relieved.

CASE 22. Age 53, para-6. Frequency with tenesmus. Six months before had had cystitis. All the acute symptoms had disappeared within one month. Frequency soon reappeared, less marked than formerly, however, accompanied by pain during micturition. *Examination:* gynecologically negative. Bladder walls hyperemic, no ulceration. Urine showed profuse growth colon-like bacilli. Rare leucocyte. Urethra very red. Granular area just distal to internal sphincter. Bled easily on passing Hank's dilator No. 18. Hexamethylenamine and bladder irrigations of boric acid for two weeks. On the third visit, we began to dilate, alternating with applications of silver nitrate 20%. Patient stated all the symptoms had disappeared in two and one half months, eight treatments.

CASE 33. Age 30, single. Slight frequency and urgency; pain before and after urination. Had had one attack lasting three months 18 years previously; present attack was of three months' duration. *Examination:* Slight thickening of left cul-de-sac. Some oedema bullosum of trigone. Urine showed moderate number r.b.c. and a few w. b. c. No. 28 F sound passed easily. Small caruncle on the floor of the urethra. Bladder irrigations of silver nitrate 1:5000 and dilatation of urethra, finally to No. 30 F.; six treatments, one a week, relieved the patient completely, save an occasional feeling of pressure.

CASE 42. Age 67, para-10. Frequency every 15 to 45 minutes by day, and 5 to 6 times by night, with pain during micturition. Duration, 8 months. No previous treatment. *Examination:* Vagina and uterus atrophied. Bladder walls showed unusual degree of capillary engorgement. On right lateral wall several shallow pockets between trabeculations. Moderate oedema bullosum about trigone. Sphincter very relaxed. Urethral mucosa very red. Definite striations, bled on passing urethroscope. First examination of urine showed profuse growth colon-like bacilli with occasional w. b. c., hazy. Hexamethlyenamine given with a resulting clear urine two weeks later.

This patient made slow progress. She was feeble and her numerous household cares gave her no time for rest. She reported, however, slight progress at each visit. The bacilluria reappeared two months after beginning treatment, after an absence from the Clinic due to a death in the family. Bladder washes of silver nitrate 1:3000 and hexamethylenamine were resorted to again. Two weeks later, with a clear urine, urethral treatment was resumed. Dilatation and applications of silver nitrate 20%, once a week, for three months, completely relieved her.

## CONCLUSIONS.

1. Chronic urethritis in women is a condition characterized by definite pathological changes in the urethra. The symptoms are usually out of proportion to the organic changes, and consist of frequency of urination, pain on voiding, and a feeling of irritation at other times.

2. This condition is probably caused in the great majority of cases by antecedent infection, either urogenous or gonorrheal. In 50 cases studied by us, infection of the tonsils and pathological conditions in the pelvis did not appear to be frequent causative factors.

3. The treatment which we have found most efficacious is gradual dilatation and the application through the urethroscope of 20% silver nitrate solution to the urethral mucosa.

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DR. ROBERT A. LAMBERT, assistant professor of pathology and bacteriology in the Yale University School of Medicine since 1919, is severing his connection with the university to assume the professorship in the department of pathology at Sao Paulo, Brazil. The chair is filled by an appointee of the Rockefeller Foundation, the professor of pathology being a member of the faculty of the school, and in academic matters to be under the direction of the dean, but appointed in coöperation with the Rockefeller Foundation.—*Science.*

## Book Reviews.

*Nursing and Nursing Education in the United States.* Conducted under the supervision of representative medical and nursing educators as follows: C.-E. A. WINSLOW, Dr. P.H., New Haven, Chairman; JOSEPHINE GOLDMARK, Secretary; MARY BEARD, R.N., Boston; H. M. BIGGS, M.D., New York; S. LILLIAN CLAYTON, R.N., Philadelphia; LEWIS A. CONNER, M.D., New York; DAVID L. EDSALL, M.D., Boston; LIVINGSTON FARRAND, M.D., Washington, D.C.; ANNIE W. GOODRICH, R.N., New York; L. EMMETT HOLT, M.D., New York; JULIA C. LATHROP, Washington, D.C.; MRS. JOHN LOWMAN, Cleveland; M. ADELAIDE NUTTING, R.N., New York; C. G. PARNALL, M.D., Ann Arbor; THOMAS W. SALMON, M.D., New York; WINFORD H. SMITH, M.D., Baltimore; E. G. STILLMAN, M.D., New York; LILLIAN D. WALD, R.N., New York; W. H. WELCH, M.D., Baltimore; HELEN WOOD, R.N., St. Louis.

Table of contents:

Part "A"—Functions of the Nurse. I. Public Health Nursing. II. Private Duty Nursing. The Subsidiary Nursing Group. III. In Institutions. The Graduate Staff. Instructors and Administrators.

Part "B"—Training of the Nurse. IV. The Hospital School of Nursing. V. Training of the Subsidiary Nursing Group. VI. University Schools of Nursing. VII. Post Graduate Courses. Public Health Nursing Courses. Courses for Teachers and Administrators in Schools of Nursing. The Teaching Staff. Teachers' College and Its Influence on Nursing Education.

This volume is the Final Report of the Committee, and is usually alluded to as "The Rockefeller Report." It came from the press in February, 1923, and is not only the latest, but by far the most complete and thorough survey ever made upon its subject. It may be stated immediately that this book of almost 600 pages is most highly recommended to anyone and everyone who is really interested in the question of Nursing in America. The names alone of the Committee are a guarantee that the work was undertaken in a broad and unprejudiced manner; the text proves that methods, investigations and conclusions are alike admirable, moderate and beyond reasonable criticism. Four years have been spent in the activities which are outlined in this volume; so that the work, while intensive, has not been too greatly condensed from the standpoint of time; and the final deductions have been drawn in an unhurried and thoughtful manner. The reviewer has found it impossible to discover any detail or essential part of the nursing problem which has been overlooked. It is important that the price of the book is extremely low.

The volume opens with an Introductory Note, of four pages, mainly historical and personal; then follows the actual Report of the Committee, condensed into about 25 pages; finally, the Report of the Survey itself, methods and details occupying rather more than 500 pages; at the end of which is found an appendix, giving the forms and schedules which were sent out in the actual collection of data: this Survey Report is written by the Secretary, Josephine Goldmark, of whose "tireless, skilful and constructive labor" the Committee speaks with well-deserved praise and appreciation. Slow and careful reading of the first 30 pages of this volume will therefore give to those interested, a view of this great problem entirely beyond anything heretofore possible from the standpoint of thoroughness, universal investigation and consequent authority. The rest of the volume may and should be studied at leisure.

There were in 1920 300,000 male and female nurses in the United States, of whom only one-half were trained and registered. This is more than double the number of the doctors at the same period; there was therefore one nurse to every 294 well persons; "an adequate supply if numbers alone are considered, provided a proper distribution could be secured; there is room for 50,000 additional nurses in Public Health alone. It is obvious that half a million nurses will be needed in this country within a few years. There are at present nearly 2000 schools, the great majority being Hospital Training Schools, which are educating (to a greater or less degree) the nurses of the future.

The broadsightedness and the activity which have characterized this great Report are equalled by the skill and judgment which have condensed its conclusion into less than 30 pages. It seems to the reviewer impossible to praise this work too highly.

*Lawson Tait: His Life and Work.* By W. J. STEWART MCKAY, M.B., M.Ch., B.Sc. New York: William Wood and Company. 1922.

This biography of Lawson Tait, by an Australian surgeon, is a valuable contribution to the history of gynecology and of abdominal surgery. It aims to give an outline of his life and work, to record some of the steps in the evolution of gynecology, and to show that Tait was really the founder of modern surgery of the abdomen. Part I, comprising four-fifths of the book, in narrating Tait's activities and career, indicates what he contributed, by his individual efforts, to the sum of surgical knowledge. Part II gives a detailed account of his method of operating, together with personal observations on his private life by the author while acting as Tait's assistant at Birmingham in 1891. In appendices are presented two of Tait's addresses on "The Image of Baal" and "The Bedstead as an Important Factor in Domestic Hygiene and

Comfort." The book is well illustrated by 34 full-page plates and forms an invaluable addition to the literature of personal and surgical history.

*Syphilis of the Innocent.* By HARRY C. SOLOMON, B.S., M.D., and MAIDA HERMAN SOLOMON, A.B., B.S. Washington: United States Interdepartmental Social Hygiene Board. 1922.

This monograph represents a study of the social effects of syphilis on the family and the community made under a grant from the United States Interdepartmental Social Hygiene Board. Practical problems, related to the familial and social aspects of *syphilis insontium*, are presented as they actually arise and are illustrated by 152 cases, chiefly from the material of the Boston Psychopathic Hospital, but partly also from several other sources. The work is divided into five chapters, dealing respectively with the individual, the mate, the child, the family, and the community. At the close of each chapter, except the first, is an excellent alphabetic bibliography of references. There are no pictorial illustrations, but the text contains 39 instructive tables.

*A Manual of Surgical Anatomy.* By LEWIS BEESLY, F.R.C.S., Edinburgh, and T. B. JOHNSTON, M.B., Ch.B., London. New York: William Wood and Company. 1923.

The first edition of this excellent volume in the series of Oxford Medical Publications has already been favorably reviewed in the JOURNAL. This second edition retains the general plan of the first, with such alterations and additions as are necessary to incorporate the advances made since 1916, particularly in the diagnosis and treatment of peripheral nerve injuries. There are 166 illustrations, including seven new radiograms. The book should have an established place as a dissecting manual for fourth-year and graduate students.

*Selected Works of Thomas Sydenham, M.D.* With a short biography and explanatory notes. By JOHN D. COMRIE, M.A., B.Sc., M.D., F.R.C.P. New York: William Wood and Company. 1922.

This volume consists of a brief but very admirable biographic sketch of Sydenham by Dr. Comrie; a table of editions of Sydenham's works and a bibliography; and a reprint of nine extracts forming about a third of his complete writings. These reprints are based on the translation of John Swan, M.D. (1742), emended in the light of the third (1705) Latin edition of Sydenham's works, and of Dr. Greenhill's Latin edition of 1844. The extracts were chosen either because they describe conditions which Sydenham was the first to record, or because they give delineations of disease that have become famous, or because they have a permanent applicability by reason of their sound common sense. Each selection is preceded by a brief explanatory note. Among the diseases considered are scarlet fever, gout, rheumatism, venereal disease, hysteria, smallpox and chorea. An appendix contains a letter from Sydenham to a patient. For students of medical history this convenient volume furnishes a valuable compendium of the life and works of "the English Hippocrates."

*Medical Diagnosis.* By CHARLES LYMAN GREENE, M.D. Philadelphia: P. Blakiston's Son and Company. Fifth edition. 1922.

The growth of this book since the publication of the first edition in 1907 shows the continuing interest of the author, and the series of editions indicates that the work has met a real demand. The fifth edition shows evidence of careful revision. A very wide field is covered, including information about many rare and little known diseases. Although, here and there, one might disagree with statements of the author, the book is essentially sound. The subject matter is presented concisely and systematically, therefore the book should be useful for ready reference. Its value is much enhanced by the inclusion of a symptom index.

*Sane Sex Life and Sane Sex Living.* H. W. LONG, M.D. Boston: Richard G. Badger. Pp. 144, $5.00.

This little book can be read in a half-hour. It is written chiefly for the prospective bride and groom, and consists of words of advice in regard to the technic of sexual congress. In the early part of the book is a description of the anatomy and physiology of the sex organs, which contains some rather remarkable statements, such as the one on page 33 relative to the passage of the ova down the Fallopian tube. "It is accomplished by a more or less copious flow of blood, a sort of hemorrhage, which carries the ova down through the fallopian tubes, and deposits them in the womb." We always believed the menstrual flow originated in the uterine cavity.

The book gives the barest outline of reproduction, and can not satisfy anyone who really wants to know what happens. Within a very limited sphere, however, it might well prove of great value. There is no doubt but what many a marriage has resulted unhappily because of a lack of the knowledge of certain facts which Dr. Long sets forth in his book. We fail to see any justification for the price asked for this little lecture, nicely printed though it is.

# Current Literature Department.

## ABSTRACTORS.

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### INTESTINAL REACTION TO ERYTHEMA DOSE.

MARTIN and ROGERS (*Am. J. Roent.*, Jan., 1923). A number of investigators have found that the intestinal reaction to an erythema dose is, in many cases, injurious and often fatal, owing to the extreme sensitiveness of the intestine to radiation.

The writers conducted a series of experiments on dogs to determine the effect of this dose on the intestinal tract of an animal. The technic used in this series was 5 in. gap, 10 in. target-skin distance, and 75 m.a. minutes as the minimum erythema dose. This dose is more than three times that given the human skin, because the skin of a dog is so much more resistant to radiation than that of a man.

It was found in this investigation that the minimum erythema dose for the dog's skin when applied directly to the intestine produces hyperemia, marked contraction in all directions, and destruction and desquamation of the mucosa. It was also observed that intestinal injury, due to direct exposure, did not always produce an early death—some dogs living 19 days.

While these experiments cannot be directly applied to the human body, it is safe to conclude that the bloody diarrhea, ulceration, perforation, and stenoses occurring in patients subjected to ultra deep therapy for abdominal tumors, may be due to direct intestinal injury. [H. A. O.]

### THE DIAGNOSIS AND TREATMENT OF BONE LESIONS: A BRIEF SUMMARY OF THE SALIENT FEATURES.

BLOODGOOD (*Am. Jour. of Roent.*, Jan., 1923). This paper deals only with those cases of tuberculous and pyogenic osteomyelitis which resemble clinically and radiographically a possible periosteal or central malignant lesion.

Routine for X-ray examination:

1. The X-ray examination should include the corresponding bone as well as the diseased bone. This should be done immediately following trauma. This is invaluable as a record for comparison if the trauma excites some benign or malignant pathological process.

2. With multiple bone lesions the writer emphasizes the importance of raying other bones before making a diagnosis of a single bone lesion.

3. Plates of the chest should also be taken, for the chest condition will, in many cases, furnish evidences which aid in diagnosing the bone lesion.

4. Palpation is a diagnostic help. When the palpation of the periosteal bone formation seems bony, it is sound to assume that the lesion is not malignant.

5. Lastly, it is very necessary to have the clinical history and the laboratory findings. Wassermann tests especially are invaluable in determining the treatment. Salvarsan is used as a diagnostic test, for a favorable reaction is rapid when the lesion is syphilitic.

A spindle-shaped periosteal growth surrounding the bone has always been considered characteristic of sarcoma, but the writer's experience points to the contrary. Calcified areas in the soft parts outside the bone involved are very suggestive of T.B. and against sarcoma.

Central Bone Lesions: Sarcoma or any other malignant tumor can be ruled out if the roentgenogram shows a distinct central lesion, with or without fracture, if the patient is under 15 years of age. If the patient is over 15, however, sarcoma cannot be excluded. Central bone lesions after the age of 15 appear in the following order of frequency: Benign giant-cell tumor, the recent and old unhealed bone cyst, sarcoma, chondroma, and myxoma.

Perforation and destruction of the bone shell are not diagnostic of malignancy, for these are present in chondroma and in bone cyst, also to a lesser degree in the giant cell tumor.

Periosteal bone lesions are difficult to diagnose, since it is hard to distinguish the periosteal sarcoma from the benign periosteal lesion. In the case of sarcoma, amputation should be considered only when other means have failed. Radium and radiations should be employed at once within two weeks to produce favorable results.

This summary, though not complete, goes far to definitely characterize bone lesions, and offers valuable aid in their treatment. The author feels that a further advance rests in the accumulation of complete histories with the follow-up system.

[H. A. O.]

### ACHLORHYDRIA: ITS RELATION TO PERNICIOUS ANEMIA AND OTHER DISEASES.

HURST (*The Lancet*, Jan. 20, 1923) discusses achlorhydria and its relation to appendicitis, cholecystitis, arthritis, pernicious anemia, etc. He emphasizes the fact that in pernicious anemia achlorhydria is primary rather than secondary, and is a predisposing factor in the development of the disease.

[R. C.]

### THE NEED FOR RESEARCH IN FRAMING TUBERCULOSIS SCHEMES.

CUMMINS (*The Lancet*, Jan. 27, 1923) emphasizes the great need for research in tuberculosis. He discusses at length the problem of infection and resistance, pointing out that the necessity for further research should be a social as well as a medical problem.

[R. C.]

### EARLY HISTORY OF ANATOMY IN THE UNITED STATES.

KRUMBHAAR (*Annals of Medical History*, Sept., 1922) sketches the early history of anatomy in the United States, from the days of the earliest recorded autopsies in 1674. The credit for initiating the scientific study of anatomy in the American Colonies belongs to Dr. Thomas Cadwalader, a Philadelphia physician of the middle of the eighteenth century. The earliest systematic lectures on anatomy, with demonstration of dissections, were given by Dr. Thomas Wood of New York in 1752. Dr. William Hunter of Newport in 1754, and Dr. William Shippen of Philadelphia in 1762. Shippen later became the first professor of anatomy in British America, in the medical department of the University of Pennsylvania. In 1768 Dr. Samuel Clossey became professor of anatomy in King's College, now Columbia University, New York; and in 1782, Dr. John Warren of Boston became the first professor of anatomy at Harvard. Dr. Krumbhaar's article is well-illustrated and has an excellent bibliography, and forms a valuable summary of its subject. [R. M. G.]

### Early Diagnosis and Treatment of Syphilis.

Ullmann (*Wien. klin. Woch.*, 7 Dec., 1922) believes that early diagnosis and intensive early treatment by all available means not only assure relief from immediate symptoms, but guarantee prevention of late lesions and insure complete and permanent cure of syphilis. [R. M. G.]

### Investigations on the Thyroid.

Breitner, from Eiselsberg's clinic, reports (*Wien. klin. Woch.*, Dec. 14, 1922) his investigations on the pathology of thyroid disease. He is particularly concerned with basal metabolism and the question of other than surgical methods of treatment, especially internal organotherapy. [R. M. G.]

### Treatment of Tuberculosis.

Andreatti (*Wien. klin. Woch.*, Dec. 28, 1922) outlines his principles in the treatment of tuberculosis. He is opposed to the direct sun-bath treatment, both in pulmonary and bone-and-joint tuberculosis, and relies primarily on a polyvalent vaccine of his own preparation called "Tualum," which produces no adverse reaction and which he believes leads to healing of tuberculous foci and establishment of active immunity. [R. M. G.]

### The Metastasizing Tendency of Oesophagus Carcinoma.

Helsley (*Annals of Surgery*, March, 1923) writes as follows: In 70 fatal cases of carcinoma of the oesophagus, metastases were present in 36 per cent. In 6 per cent. the secondary growths were limited to the regional lymph-nodes. This indicates a limited tendency to metastasize.

The average duration of symptoms, 4.8 months, in the patients who died without metastases indicates that in the majority of cases ample time is given for diagnosis and treatment before metastasis occurs.

However, the striking change for the worse in the pathological picture during the average of 69 days by which the group that survived gastrostomy outlived the group that succumbed thereto, gives warning of the speed with which metastases develop in a somewhat advanced stage of the disease.

Irrespective of the duration of the disease, the possibility of metastasis formation, without definite evidence of same, should not be considered as a contraindication to radical operation. [E. H. R.]

### Papilloma and Adenoma of Gall-Bladder.

Abell (*Annals of Surgery*, March, 1923) writes as follows: Benign tumors of the gall-bladder, notably papilloma and adenoma, are not so rare as formerly thought, occurring in the Mayo series once in every 23½ cases of cholecystectomy and once in every 36 cases of the series herewith reported.

The invariable presence of chronic inflammatory changes in gall-bladders containing such tumors would argue the importance of chronic irritation as an etiological factor in their development.

The overshadowing clinical picture is that of cholecystitis, there being no correlation of symptoms with the presence of such tumors.

The fact that such tumors occur in the course of chronic cholecystitis is an additional argument in favor of cholecystectomy. [E. H. R.]

### Treatment of Diverticulum of the Oesophagus.

Mayo (*Annals of Surgery*, March, 1923) presents a short but concise article on the surgical treatment of this condition. He believes that early operation, before the sac becomes too large and thinned out, is much more liable to be successful and without complications than if one waits until the sac has become more defined. The danger of mediastinal infection of course is always present.

With large sacs the two-stage operation is practically always necessary, but with small sacs there is little difficulty in amputating and suturing at the junction with the oesophagus, using two rows of chromic catgut and a small drain. Large sacs should be delivered unopened, packed around with a layer of gauze, and should be amputated and closed by suture within from ten to twelve days. In this period between the first and second stage of the operation, the mediastinal space becomes closed and protected by granulation tissue. [E. H. R.]

### The Treatment of Anthrax Infections.

McGlannan (*Annals of Surgery*, March, 1923) publishes the reports on six cases of anthrax treated by electric cautery excision of the focus of infection. All cases recovered without complications. This is in direct contrast to recent series of cases reported by other authors who have strictly avoided interference with the primary lesion. Of course, the number of cases is too small to form a definite line of treatment by, but they are on the other hand very suggestive. [E. H. R.]

### White Bile in the Common Duct.

Judd and Lyons (*Annals of Surgery*, March, 1923) believe the term, "white bile," is a misnomer. It is applied to the colorless liquid commonly found in the common and hepatic ducts. Although the gall-bladder often contains a colorless liquid, such a liquid is only rarely found in the common and hepatic ducts. The origin and nature of this so-called "white bile" is undetermined, but it is generally believed that its presence indicates greater operative risk.

In the last four years 649 operations have been performed on the common or hepatic ducts at the Mayo Clinic. In this group there were 19 in which "white bile" was present; in 9 of these obstruction was due to stone in the common or hepatic duct; and in 6, to trauma at a previous cholecystectomy; in 2 the obstruction was due to carcinoma, one of the pancreas and one of the ampulla; and in 1 it was due to pancreatitis; 17 of the patients were intensely jaundiced at the time of operation and there had been no recent decrease in the jaundice. In these 19 cases, there were four operative deaths, an average mortality of 21%. While the operative mortality was high, it is probably no higher than it would be in a series of cases of complete biliary obstruction of the same duration with green bile in the common and hepatic ducts. Loss of weight was a striking feature in the histories of these patients, often suggesting malignancy.

The authors state it cannot be assumed that "white bile" indicates that the liver is not secreting. They have seen what they term "liver shock" in certain cases of jaundice which has seemed to come after sudden complete and permanent relief of pressure in the common duct. This shock has usually come on several hours after an operation, when the immediate effects of the operation had apparently passed.

Cases in which there is white or colorless fluid in the common duct represent a very serious surgical type. They are not, however, necessarily fatal as the finding of this fluid in the duct does not mean that the liver is interfered with more than in any badly jaundiced patient. This colorless fluid, or so-called "white bile," is the product of the glands of the duct wall. It is secreted under sufficient pressure to continue to form regardless of the secretion of bile from the liver and it collects in the ducts only when the activities of the gall-bladder are destroyed. The bile reports of 19 cases are presented in this article. [E. H. R.]

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## WHERE FEDERAL AND STATE LAWS MEET AND CONFLICT IN WORKMEN'S COMPENSATION.

THERE has been much uncertainty for several years in all the States of the Union, including Massachusetts, as to where the jurisdiction of the State ended and that of the United States began, particularly as to cases affecting the rights of injured workmen and their dependents under Workmen's Compensation Acts. This uncertainty has been cleared up, at least to some extent, by the recent able decision of the Massachusetts Supreme Judicial Court, written by Chief Justice Rugg, in the case of Gillard *v.* Bethlehem Shipbuilding Corporation.

The laws of Massachusetts have no effect outside the boundaries of the Commonwealth. The Workmen's Compensation Act is not applicable to purely maritime torts, or injuries on the navigable waters of the United States. These injuries are without question outside the scope or effect of the compensation law. Injuries occurring upon wharves or docks, which are merely adjuncts to the lands, are within the scope of the special state compensation act. Injuries occurring on land ceded to the United States by the Commonwealth, such as the land at the Charlestown Navy Yard, are not within the purview of the compensation law.

The Gillard case involved the rights of a dependent widow to compensation for the death of her husband. His death resulted from a fatal injury received while engaged in construction work upon an uncompleted vessel which had been launched and which was at the time of his injury upon the navigable waters of the country at Fore River. The question before the Court, therefore, was whether, in view of previous state decisions, including prior United States Supreme Court decisions, Gillard's widow could recover compensation under the Massachusetts Act.

After stating that the Superior Court had found that the work of Gillard as a carpenter on the uncompleted vessel was non-maritime in its nature, and that the construction of a vessel was non-maritime as well, the Court said that it was within the power of the Commonwealth to regulate the rights, obligations and consequent liabilities of the parties by the compensation law and held that such regulation "would not necessarily work material prejudice to any characteristic feature of the general maritime law, or interfere with the proper harmony or uniformity of that law in its international or interstate relations."

So that it may now be said, in view of this latest decision considered in connection with previous United States Supreme Court decisions, that the laws of the nation and state conflict, so far at least as workmen's compensation is concerned, when the injury received by the workman has its origin in a risk strictly maritime in its nature and not otherwise. Therefore, all injuries occurring on land, on docks or wharves, and vessels which as yet are not completed, although riding on navigable waters while in process of being completed, are within the jurisdiction of the compensation statute.

### DECREE OF THE SUPREME JUDICIAL COURT.

Hg. No. 7633.

| | |
|---|---|
| Edward C. Gillard. | Employee. |
| Bethlehem Shipbuilding Corp., | Employer. |
| U. S. Mutual Liability Insurance Co., | Insurer. |

RUGG, C. J.: This is a proceeding under the Workmen's Compensation Act. The case was heard by a board member, who stated as agreed facts that the employee received an injury in the course of and arising out of his employment on the ship "Cohasset" on November 14, 1918, and that the employer had knowledge of the injury. He then stated that the questions were: "(1) The insurer contends that the injury occurred on a ship in navigable waters and therefore the board is without jurisdiction, and (2) Dependency." The board member made report of the evidence, found that the injury "occurred on navigable waters," and ruled that the case was not within the jurisdiction of the board and dismissed the claim. The industrial accident board on review stated the "Questions" to be: "(1) Jurisdiction and (2) Dependency," found that the "report of the Board Member contains all the material evidence" and affirmed the ruling of the board member on the jurisdictional

ground. The case then came before the Superior Court, where a decree was entered reciting that it "was agreed by the parties that at the time of the injury for which compensation is sought, the employee was engaged in the work of the original construction of a vessel which had theretofore been launched" and adjudging "that the work of the employee at the time of said injury was non-maritime in its nature," and ordered the insurer to make payments to the two minor children of the deceased employee at the rate of ten dollars per week. It was agreed that the wages of the employee were sufficiently large to entitle total dependency to that sum as the maximum.

The original claimants were Annie M. Gillard, alleged widow, and Jessie and George C. Gillard, minor children. During the hearings before the board member Annie M. Gillard withdrew as claimant, leaving the minor children as the only claimants.

The reported evidence, which was not contradicted in any particular and which manifestly formed the basis of the findings of fact of the board member and to which resort may be had as background for the findings of the industrial accident board, was in substance that the ship, "Cohasset" was launched on November 3, 1918, at the Quincy yard of the Fore River Shipbuilding Corporation into the Fore River, which is navigable water; that the ship then was towed around the dock, to which it was tied with Manila and steel wire lines; that a portable gangway, which was lifted over the side of the ship and which was not secured in any way except by its own weight, was put on board for workmen to get on and off the ship; that the ship was then about seventy-five per cent. completed, no engines, boilers or machinery except some piping being then installed; that all these were put into the ship while she was tied up to the dock; and that after completion the ship was delivered to the government, and that the employee was doing some kind of carpentering work in connection with the completion of the ship while she was to that end tied up to the dock.

The words of G. L. c. 152, s. 1 (4) are that "Employee" as used in the act, means "Every person in the service of another under any contract of hire, express or implied, oral or written, except masters of and seamen on vessels engaged in interstate or foreign commerce."

The words of the Workmen's Compensation Act, now G. L. c. 152, formerly St. 1911, 751, are broad enough in their scope to include maritime torts except and so far as jurisdiction of the General Court of Massachusetts in that particular is excluded by the grant of power to the United States in "all cases of admiralty and maritime jurisdiction." U. S. Constitution, Art. III, s. 2, Art. I, s. 8. In several instances jurisdiction under the Workmen's Compensation Act over an injury which might have been argued to be maritime in its nature was taken without the point being raised, discussed or thought of. *Gillen's Case*, 215 Mass. 96. *Brightman's Case*, 220 Mass. 17. *McManaman's Case*, 224 Mass. 554. The only significant point in this connection is that by a verbal interpretation of our Workmen's Compensation Act, apart from constitutional considerations, maritime torts are included. *Dorman's Case*, 236 Mass. 583, 584. Although these words are broad enough, as mere matter of grammatical construction to include strictly maritime torts exclusively within admiralty jurisdiction, yet it is familiar law (to quote the words of Chief Justice Knowlton) that "a statute which would be unconstitutional as applied to a certain class of cases, and is constitutional as applied to another class, may be held to have been intended to apply only to the latter class, if this seems in harmony with the general purpose of the Legislature." *Attorney General* v. *Electric Storage Battery Co.*, 188 Mass. 239, 241. *Manchester* v. *Hopkin*, 237 Mass. 434, 440. *United States* v. *Standard Brewery, Inc.*, 251 U. S. 210, 220. The Workmen's Compensation Act, therefore, must be and is interpreted as intended only to operate upon the classes of employment and injury within the jurisdiction of the General Court. On the other hand the words of the act and its chief aim rendered the conclusion irresistible that the General Court intended to make the act applicable to all classes of injuries therein described which are within its jurisdiction. "The statute is as broad as the jurisdiction of the Commonwealth." *Kinney* v. *Treasurer and Receiver General*, 207 Mass. 368, 369.

In none of the cases which have come before us since the decision of *Southern Pacific Co.* v. *Jensen*, 244 U. S. 205, have we undertaken to delimit the jurisdiction of the Commonwealth under the Workmen's Compensation Act further than to apply to specific cases the principles of that decision as we understood them. *Duart* v. *Simmons*, 231 Mass. 313, S. C. 236 Mass. 225. *Sterling's Case* 233 Mass. 485. *Proctor* v. *Dillon*, 236 Mass. 538, 544, 545. *Sterling* v. *Frederick Leyland & Co. Ltd.*, 242 Mass. 8. The language of that act, in view of its beneficent purpose, ought not to be narrowed any further than jurisdictional bounds demand.

So far as our own decisions are concerned, we are quite at liberty to extend the Workmen's Compensation Act to any case to which it is applicable under the adjudications of the Supreme Court of the United States, and it is our duty so to extend it in order to effectuate the intention of the Legislature.

It seems to us that the case at bar is indistinguishable on its facts from those in *Grant Smith-Porter Co.* v. *Rohde*, 257 U. S. 469. There was a proceeding in admiralty to recover damages for personal injuries to an employee while at work as carpenter on a partially completed vessel lying at dock, in navigable waters within the state of Oregon. In that State there was operative a Workmen's Compensation Act, which in effect gave both to employer and employee an option to accept or reject the law and which, if not rejected, made the relief afforded thereby to the employee in lieu of all claims against his employer for injuries or death, with exceptions not here relevant. Neither the employer nor employee took the steps necessary to reject the act and thereby both came within its operation. It was held that although the injury was maritime because occurring in navigable waters, nevertheless the exclusive features of the Oregon Workmen's Compensation Act applied and abrogated the right to recover damages in an admiralty court which otherwise would exist. It was said, 257 U. S. 475-476, that the contract for the construction of a vessel "was non-maritime," and although the incompleted structure upon which the accident occurred was lying in navigable waters, neither Rohde's (the employee's) general employment, nor his activities at the time had any direct relation to navigation or commerce. *Thames Towboat Co.* v. *The Schooner "Francis McDonald,"* 254 U. S. 242. The injury was suffered within a State whose positive enactment prescribed an exclusive remedy therefor. And as both parties had accepted and proceeded under the statute by making payments to the Industrial Accident Fund it cannot properly be said that they consciously contracted with each other in contemplation of the general system of maritime law. *Union Fish Company* v. *Erickson*, 248 U. S. 308. Under such circumstances regulation of the rights, obligations and consequent liabilities of the parties, as between themselves, by a local rule, would not necessarily work material prejudice to any characteristic feature of the general maritime law, or interfere with the proper harmony or uniformity of that law in its international or interstate relations. *Southern Pacific Co.* v. *Jensen*, 244 U. S. 205; *Western Fuel Co.* v. *Garcia*, *ante*, 233. "The general doctrine that in contract matters admiralty juris-

diction depends upon the nature of the transaction and in tort matters upon the locality, has been so frequently asserted by this court that it must now be treated as settled. The Workmen's Compensation Law of Oregon declares that when a workman subject to its terms is accidently injured in the course of his employment he 'shall be entitled to receive from the Industrial Accident Fund hereby created the sum or sums hereinafter specified and the right to receive such sum or sums shall be in lieu of all claims against his employer on account of such injury or death.' In *Western Fuel Co.* v. *Garcia, supra,* (257 U. S. 233) we recently pointed out that, as to certain local matters regulation of which would work no material prejudice to the general maritime law, the rules of the latter might be modified or supplemented by state statutes. The present case is controlled by that principle. The statute of the State applies and defines the rights and liabilities of the parties. The employee may assert his claim against the Industrial Accident Fund to which both he and the employer have contributed as provided by the statute, but he cannot recover damage in an admiralty court. This conclusion accords with *Southern Pacific* v. *Jensen,* 244 U. S. 205; *Chilentes* v. *Luckenbach S. S. Co.,* 247 U. S. 372; *Union Fish Co.* v. *Erickson,* 248 U. S. 308; *Knickerbocker Ice Co.* v. *Stewart,* 253 U. S. 149. In each of them the employment or contract was maritime in nature and the rights and liabilities of the parties were prescribed by general rules of maritime law essential to its proper harmony and uniformity. Here the parties contract with reference to the state statute; their rights and liabilities had no direct relation to navigation, and the application of the local law cannot materially affect any rules of the sea whose uniformity is essential."

Our Workmen's Compensation Act differs in no essential particular from the Oregon act as described in the opinion in the Rohde case, so far as affects the case at bar. An employer who becomes insured according to our Workmen's Compensation Act is required to give notice thereof to his employees, G. L. c. 152, s. 21, to those who thereafter enter his employment, s. 22, and the employee is held to have waived all his common law rights of action if he does not within a specified time give to his employer written notice that he claims such rights, s. 24, and the filing of a claim under the act or acceptance of payment from the insurer or submits to a hearing constitutes also a release by the employee to his insured employer, s. 23. The employer who insures under the act is relieved from all statutory liability under the employers' liability act. G. L. c. 152, s. 68. Thus it is wholly optional with both the employer and the employee whether to become subject to the act or to stay out of it. Each has an absolute choice to act according to his own conceptions of his interests. Only when both concur in accepting it, does the act become operative. When both employer and employee exercise their option to accept the provisions of the act, a method of accident insurance according to schedule established by the act for all injuries sustained by the employee, including death arising out of and in the course of his employment, is substituted for common law and other statutory rights and liabilities for such injuries and death. *Young* v. *Duncan,* 218 Mass. 346. The purpose of the General Court by the Workmen's Compensation Act was to take away from employees, who become subject to its provisions by failing to give notice of a reservation of their common law rights, all other remedies against any insured employers for injuries arising out of and in the course of their employment, and to substitute the wider right of compensation under the act. The remedies provided under the Workmen's Compensation Act are exclusive of all other relief and obligation to employees and employers who voluntarily adopt its provisions. *White* v. *E. T. Slattery Co.,* 236 Mass. 28. *Zygmuntowicz* v. *American Steel & Wire Co.,* 240 Mass. 421. *McDonnell* v. *Berkshire Street Railway,* 243 Mass.

The circumstance that in Oregon both parties contribute to an industrial accident fund, while under our act the employer alone incurs expense by becoming insured in accordance with G. L. c. 152, s. s. 52 to 65, both inclusive, seems to us immaterial to the issues here depending. So also is the express provision of that act including shipbuilding. Our act is equally operative upon that branch of industry although not specified. There is no essential difference between the words of that act, that rights thereunder shall be "in lieu" of other claims, and the terms of our act in making remedy thereunder exclusive of all others against the employer. See in this connection *State Industrial Commission of New York* v. *Nordenholt Corp.,* 258, U. S., 42 Sup. C't, Rep. 473. *Western Fuel Co.* v. Garcia 257 U. S. 233. *New Bedford Dry Dock Co.* v. *Purdy,* 258 U. S. 96. *Netherlands American Steam Navigation Co.* v. *Gallagher,* 282 Fed. 171, 189, C. C. A. See, however, *Hoof* v. *Pacific American Fisheries,* 279 Fed. 367, C. C. A.

As we understood the decision in *Grant-Smith-Porter Co.* v. *Rohde,* 257 U. S. 269, it is precisely applicable to the facts of the case at bar. It follows that jurisdiction of the case at bar is vested in the tribunals of this Commonwealth under the Workmen's Compensation Act and under the Constitution of the United States.

It was the duty of the judge of the Superior Court to enter such decree as the law required on the facts found even though contrary to the decision of the industrial accident board. *McNicol's Case,* 215 Mass. 497, 592. *Bell's Case,* 238 Mass. 46, 52. Therefore, he was entirely within his judicial function in reversing the rulings of law of the board member and of the industrial accident board as to jurisdiction, which may well have been made before the decision in the Rohde Case came to their attention.

The insurer contends that the record does not warrant a decree for the dependents because there is no finding that the employee elected to come under the act, or that he was not injured by his own serious and willful misconduct. There is nothing in these contentions. The insurer raised no such points before either the board member or the industrial accident board. The report of which stated exclusively that the questions raised were (1) jurisdiction and (2) dependency. The insurer must be taken to have waived all other questions and cannot raise them now for the first time. If there was any mistake in the record, appropriate proceedings for its correction should have been taken seasonably. *Doherty's Case,* 222 Mass. 98.

The suggestion that there was informality in entering the case in the Superior Court made for the first time in this court also comes too late. That court had jurisdiction of the cause and the parties. *Paige* v. *Sinclair,* 237 Mass. 482.

There is no express finding of fact concerning dependency of the minor children. That is stated both by the board member and the industrial accident board to have been one of the "questions" presented by their decision. Neither made any decision of that question. It seems pretty clear that dependent minor children are conclusively presumed to be wholly dependent upon the father with whom they live in the absence of claim by a widow. G. L. c. 152, s. 32 (c). *McNicol's Case,* 215 Mass. 497. *Murphy's Case,* 224 Mass. 592, 595. *Gritta's Case,* 236 Mass. 204. The fact of dependency may have been agreed in the Superior Court as basis for the decree. However that may be, the insurer has not argued this point and therefore, under the familiar general rule, it must be treated as waived. *Commonwealth* v. *McCue,* 121 Mass. 358, 360. *Iasigi* v. *Shea,* 148 Mass. 538. *Swan*

v. *Boston Elevated Railway*, 188 Mass. 405. *Chiappini* v. *Fitzgerald*, 191 Mass. 599.

*Decree Affirmed.*

## "NOTHING BUT THE TRUTH."

THE gullibility of man is limited only by the scope of his imagination, although it is in some measure modified by the degree of intelligence which he possesses. "In some measure" we say advisedly, for we know that in fields which lie outside his exact knowledge even the most intelligent of men will often hold reason in abeyance and believe that which he wishes to believe, or that which appeals to his fancy, his imagination, or that innate love of the mysterious which lies in all of us. Thus we have the examples of Bishop Berkeley exploiting his tar water, George Washington (so it is said) purchasing from Elisha Perkins a pair of metallic tractors for family use, and in our own more enlightened day countless numbers seeking health through the many irregular methods that we are all aware of.

As each extravagant claim and each unwarranted belief is promulgated, however, there is always that large number of reasoning individuals who, either through natural wisdom or exact knowledge, know that these claims and beliefs are unsubstantial and faulty. It is through these persons that the acceptance or rejection of unusual ideas should come, and it is by them that the minds of the people should be directed into the proper channels when occasions of doubt, or bewilderment, or spurious belief are likely to arise.

It is inconceivable to believe that our daily press should not have men of this caliber intimately concerned with the directing of its policies; it is also inconceivable to believe that our press, for the sake of presenting the spectacular to its readers, or for more baldly commercial reasons, should print as news or advertisement statements, in the guise of fact, which may be detrimental to the public interest. Inconceivable or otherwise, we must acknowledge that this is done.

Editorial policies and news and advertisements we find are conveniently separate, for the advertising pages of a newspaper which, editorially, professes great interest in the public welfare, will flaunt proprietary gland preparations before our eyes, and in the news section we will find considerable concern exercised lest Lord Carnarvon's insect bite might be the imperial punishment of a long dead Pharaoh, although, in another section of the same issue, we may read a denial of this possibility. "Let not thy right hand know what thy left hand doeth" might almost be adopted as a motto by many publications.

There is great power for harm in such statements and advertisements, and we have seen too much of this loose thinking and unscrupulous advertising lately. The newspaper is the most powerful instrument in the world for shaping public opinion, and its responsibilities are too great to be taken lightly. Quotations concerning the power of the pen are hackneyed, but it is very near the truth to say that high-minded and public-conscienced editorial staffs are more valuable than college faculties.

## SYPHILIS.

SALVARSAN by no means solved the problems of preventing and curing syphilis. The dangers involved in the use of the preparation have been greatly lessened by the more recent and improved modifications. The newer and simpler forms of administration have made possible a much wider use of the remedies. The results are that in the larger clinics fewer cases of early syphilis are seen than was formerly the case. The lesions by which the disease is spread are more promptly controlled. The educational methods pursued during the war and afterward have tended to bring about a realization of the dangers involved in the acquisition of syphilis and a more prompt and ready acceptance of treatment.

But that all these factors have minimized the later manifestations of syphilis is by no means certain. Congenital syphilis persists. The manifestations in the cardio-vascular system and in the central nervous system are thought by many not to have decreased. This apparent failure to cut down the occurrence of these most distressing conditions is due in part to better diagnostic methods. But without question the late manifestations have not decreased as have the earlier symptoms.

The general practitioner of today is able to do much to suppress promptly the early lesions. But the imperative obligation remains to prevent the spread of the disease to succeeding generations and to organs, the involvement of which may produce years of physical and mental impairment.

The discussion of this subject in a series of short papers at the annual meeting of the Suffolk District Medical Society on April 25 ought alone to be of great interest to all physicians, who will be welcomed whether or not members of the Society. But the review of the subject of the treatment of syphilis, past, present and future by one of such experience, sound judgment and breadth of vision should by itself attract a large audience to hear Dr. Abner Post.

## HEARINGS BEFORE THE BOARD OF REGISTRATION IN MEDICINE.

ON April 4, this Board considered several complaints relating to irregular practice, ranging from suspected criminal abortions to failure to report birth returns.

Attendance at these hearings demonstrates the disadvantage of not having skilled investigators under the control and direction of this Board, for the complainants often assume that the Board will engage actively in the complicated processes involved in detective work and the preparation of evidence. In order to secure the best results, proper investigators should be provided. The Board could discharge its functions much more satisfactorily if it could act purely as a court and leave the procedures involving the presentation of evidence and cross-examination of witnesses to experts.

The problems presented by alleged criminal or unethical acts are often complex and difficult to pass upon, and it would be far easier for this Board to act in a judicial capacity if not handicapped by having to meet the opposition of adroit and well-trained lawyers. Although handicapped in having oftentimes to act as investigator and prosecutor, it is evident that there is a definite purpose in the minds of the members of the Board to adhere strictly to an impartial attitude and give due importance, pro and con, to all the testimony submitted.

In their recent hearing it was clearly shown that the action of the members was lenient, for the acknowledgment of error and promise to reform led to the decision that merciful action would not impair justice.

Repeated failures to report births has led authorities responsible for our vital statistics to ask for definite action in dealing with careless doctors. If compliance with the law is not shown in the future, some physicians will have to arrange for an enforced vacation.

## FIXING REQUIREMENTS FOR SPECIALISTS.

The American College of Surgeons is setting a standard minimum requirement for qualification as a Fellow in the College. Doubtless there are some surgeons qualifying as Fellows who are not of the highest calibre, but a certificate from the College guarantees at least *some* training of the possessor. Why should not the various societies of specialists—for example, the eye, ear, nose and throat surgeons—establish a minimum standard for qualification to practice in each individual specialty? Is not a tonsillectomy or a septum operation well done just as difficult as an appendectomy?

The roll of membership in each smaller college should be published widely, and made easily accessible to the public. It would be a great comfort for a patient to *know* that in a "specialist's" office he was seeing a real specialist.

## NEW "CURE" FOR BALDNESS.

It is difficult for us to understand how it is possible to convert "by hydrolysation the constituents of keratin, the primal basis of hair and nails," into a substance that when administered by mouth will stimulate the growth of hair. Yet such a preparation, "Humagsolan," is seriously described in a reputable British medical journal as a remedy for baldness!

It is our belief that the "constituents of keratin" are already found in ordinary diets—and that the production of keratin by the body is the essential process—rather than the absorption of fresh "constituents." We should like to learn the price of Humagsolan per bottle!

## LEGISLATIVE MATTERS.

### Compulsory Vaccination Law.

The New Hampshire House of Representatives has passed the bill which provides for repeal of the law which requires vaccination of school children, after a bitter contest. There is no reference to the action of the Senate in the report.

# Miscellany.

## SURGICAL SECTION MEETING OF THE BOSTON MEDICAL LIBRARY, IN CONJUNCTION WITH THE SUFFOLK DISTRICT MEDICAL SOCIETY.

At the Surgical Section meeting of the Boston Medical Library, in conjunction with the Suffolk District Medical Society, held at the Boston Medical Library, on March 28, the Society was addressed by Dr. Howard Lilienthal, of New York, who gave "A Review of What Surgery Can Accomplish in Diseases of the Thoracic Organs." Dr. Lilienthal first reviewed the physical conditions in the closed thorax and their modification on opening it, and gave it as his opinion that under proper precautions the technical difficulties and dangers of an intrathoracic operation need be no greater, if as great, than those attending an abdominal operation. The key to success lies in preventing collapse of the lung and violent flapping or oscillation of the mediastinal organs by placing the patient in a negative pressure chamber or by employing positive pressure inhalation anesthesia by the intra-tracheal or intra-pharyngeal tube, or even by the closed face mask method. The speaker emphasized the fact that perfectly satisfactory results could be attained by the simplest apparatus such as a Paquelin cautery bulb. In empyema the oscillation of the mediastinum does not occur when the chest is opened, on account of the pleural thickening and adhesions.

Dismissing empyema as a lesion whose treatment is now fairly satisfactory, Dr. Lilienthal discussed lung abscesses, dividing them into the embolic and inhala-

tion types. The early diagnosis before rupture into the bronchus may be very difficult, but a clue is sometimes given by the foul odor of the breath before the appearance of sputum. The speaker strongly advocated early drainage of abscess by thoracostomy before it had ruptured into the bronchus. After such rupture there is usually no need for haste, and in a certain number of cases Nature will effect the cure relatively unaided, or artificial pneumothorax may be a great help. After bronchial rupture, external drainage may be postponed for a considerable time while these methods are tried. The exploration of lung abscesses by the hollow needle through the chest wall was strongly condemned as likely to lead to infection of the pleural cavity or of the intermuscular planes of the parietes, but where this procedure is necessary the danger may be lessened by the injection through the needle of a little alcohol before and during its withdrawal. The danger of a tension pneumothorax occurring either through rupture of a bronchus into the pleural cavity or a traumatic opening of the chest wall with the formation of a valve was strongly emphasized, together with the immediate relief obtained by the release of tension by paracentesis.

Dr. Lilienthal then spoke of the etiology and pathology of bronchiectasis and outlined his practice in examining these cases first with the bronchoscope to determine the exact condition, and treating many of them by local disinfection, which is not a serious ordeal, and gives temporary relief. Permanent drainage by thoracostomy and opening the bronchiectatic cavities, with establishment of a permanent fistula, was highly commended, and in some cases the condition may heal to such an extent that the fistula can be closed. In selected cases lobectomy may be justified, in spite of its very high mortality which, the speaker said, was 50 per cent. in his own cases. He described the desperate condition of these patients, who were a nuisance to themselves and society on account of the terrible odor associated with the condition, and said that an operation which promised a cure, even at the expense of very high mortality, was amply justified. In this connection, he emphasized the very high mortality attending radical resection of the stomach for ulcer or carcinoma, which, nevertheless, does not deter physicians from recommending these operations. The technic of lobectomy was described.

The speaker briefly mentioned the surgery of pulmonary tuberculosis, the freeing of adhesions to permit collapse by pneumothorax, the occasional performance of lobectomy, and the collapse of the chest wall by wide rib resection. He was enthusiastic over the good results of pneumothorax in suitable cases.

Dr. Lilienthal then considered the surgery of malignant neoplasm of the lung, which begins either in the parenchyma of the organ or at the bifurcation of a secondary bronchus. In both these situations, it was his opinion that these cases, if diagnosed comparatively early, offered as good an opportunity for radical removal and cure as does malignant disease in some other apparently more accessible regions of the body.

The meeting was largely attended by members of the Suffolk and other district societies, and the address was listened to with the greatest interest. It was discussed by Dr. F. T. Lord, Dr. Horace Binney, Dr. John B. Hawes, 2d, and Dr. Wyman Whittemore. The many excellent stereopticon slides contributed much to the understanding of the speaker's remarks.

## ESSEX SOUTH DISTRICT MEETING.

A meeting of the Essex South District Medical Society was held at the Lynn Hospital on April 3, at 5 P.M., with eighty in attendance. The following cases were demonstrated by members of the staff from 5.30 to 7 o'clock:

Arthrodesis of Elbow, Spontaneous Fracture of Femur, Dr. Harvey Newhall.

Gas Bacillus Infection, Dr. Loring Grimes.

Intestinal Obstruction, Dr. George H. Kirkpatrick.

Some Clinical Experiences with Radium, Dr. Orrin C. Blair.

Pericarditis with Effusion; Purpura; Meningitis, Dr. Ralph E. Bicknell.

Double Torsion of Cord, Ureteral Calculus, Dr. Harold Johnson.

Cor. Bovinum; Carcinoma of Stomach, Dr. W. L. Hearn.

Dentigerous Cyst of the Superior Maxilla, Dr. M. C. Smith.

X-ray demonstrations, Dr. Ester M. Sundelöf. Demonstrations in Laboratory, Dr. Maurice T. Briggs.

Dinner, at seven o'clock, was followed by an essay on "Influenza Pneumonia," by Dr. Channing Frothingham, Boston. Adjourned at 10 P.M.

W. T. HOPKINS, *Reporter.*

## WORCESTER DISTRICT MEDICAL SOCIETY.

A meeting of the Society was held at Memorial Hospital, Worcester, on April 11, at 8 P.M. The program was as follows:

Observations on the Transfusions of Blood, Dr. Donald Adams.

Deformities of the Pelvis in Pregnancy (x-ray plates), Dr. Joseph O'Connor.

Lymphosareoma Treated by X-Ray (case report), Dr. Philip H. Cook.

The Placental Infaret and Its Relation to the Etiology of Deformed Babies, Dr. John Talbot.

Brown-Séquard Paralysis Following Cervical Fracture and Dislocation, Dr. Benjamin T. Burley.

Brain Abscess of Nasal Sinus Origin (case report and demonstration of pathological specimen), Dr. Gordon Berry.

A Brief Report on the Use of Insulin, Dr. Oliver Stansfield.

A meeting of the Censors will be held on Thursday, May 3, at 4 P.M., at the Worcester Public Library, Elm Street.

GEO. E. EMERY, *President*,
A. W. ATWOOD, *Secretary*.

## MEDICAL NOTES FROM THE NUTRITION INSTITUTE FOR DELICATE CHILDREN.

THE Fall River Institute on the Nutritional Problems of Children was held from February 8th to the 21st. There were sixty-five persons who took the course, including a number of physicians, six of whom volunteered for service in nutrition classes. The Rotary Club was responsible for planning and organizing the institute, and twenty-three child-helping organizations of the city coöperated in the undertaking. Both public and parochial schools entered heartily into the nutrition program. The best results were secured in an orphanage which has now started to equal the record of five orphanages in other cities which have entirely done away with malnutrition among the children in residence. Students were in attendance from all the social groups of Fall River and from Boston, Portland, Me., and Colorado Springs.

A new feature at the institute held at Newark, N. J., from March 5th to 17th, was the broadcasting by radio of Dr. Wm. R. P. Emerson's address on "The Malnourished Child." Many letters have come to him from persons in various parts of the country who were interested in the subject by this means. There were 115 full-time students in the course, besides a number of special workers who attended part time. Two nutrition workers who will spend the summer in Labrador with the Grenfell Association were in attendance. Among the visitors were Miss Scott of the Canadian Patriotic Fund, who will assist in the Richmond Institute, and Miss McMullin, of Rochester, who was on her way to take a position as supervisor of nutrition classes in Honolulu. Dr. Charles Hendee Smith of Bellevue Hospital in New York City spoke on "Malnutrition and Tuberculosis." Dr. Herben, who took the course at Rochester, told of her chain of classes in connection with the work of the Tuberculosis Association of New York City; Dr. Don C. Bliss, superintendent of public schools in Montclair, New Jersey, reported on the nutrition program in that city, which has reduced the percentage of malnutrition in that city from 30% to 14%. Mrs. Ethel McC. Hendriksen spoke on the work in Rochester, which has the most extensive program in operation in both public and parochial schools. In that city all the school principals and all teachers of physical education have taken the institute course of training. The Newark meeting was in charge of the New Jersey Tuberculosis League, Inc. Dr. Emerson addressed the medical societies of Passaic and Newark.

From Honolulu came a report of the introduction into the territorial legislature of an act to provide $24,000 to support the nutrition program until funds can be secured by the school authorities for this purpose.

## IS AMERICAN YOUTH MORE COWARDLY?

The tragic death of a boy, aged 15, at the Blue Coat School, left the disturbing impression that his act of suicide was due to some cruelty practised upon him by his companions. The result, however, of an exhaustive inquiry completely disproved this aspect of the case. Much comment was also caused that a boy of so young an age should have destroyed his life. And yet a reference to the Registrar General's Returns, shows that cases of the kind are not infrequent, both among boys and girls. Inquiry generally elicited that some domestic incident was the cause of the act, such as punishment for an offence. In 1920, nevertheless, 42 boys under fifteen and 44 girls committed suicide. In this series thirteen boys drowned themselves, and two used cutting or piercing instruments, while 28 girls drowned themselves, and in three cases cutting instruments were used. The other means resorted to, both by boys and girls, were various. In every instance it may be assumed that the underlying cause of the act was a hyper-sensitiveness which magnified into a grievance some trivial incident which for the time being disturbed the order of the lives of these young children. In this respect they were abnormal, and their mental balance passed out of control. —*Medical Press.*

## ZINC POISONING.

The London *Lancet* reports a sudden outbreak of illness in a large institution near London, due to the use of galvanized iron vessels in cooking fruit.

In this case apples were stewed in the containers, and shortly thereafter those partaking complained of dizziness, sickness, or a feeling of sickness, colic, and tightness in the throat. Examination of the stewed apples showed that they contained 7 gr. of zinc oxide per pound, this being equivalent to 25 gr. of hydrated zinc sulphate, or about the emetic dose (10-30 gr.).

The action of the vegetable acids on the metal was no doubt the cause of the accident. The possibility of such occurrences should be recognized and guarded against.

## THE RESULTS OF EXAMINATIONS OF APPLICANTS ON REGISTRATION AS PHYSICIANS IN MASSACHUSETTS FOR THE YEAR 1922.

The number of persons applying for registration through examination, for the first time this year, is 293, all of whom have been examined except 6. In addition there were 70 who had failed in previous examinations, making the total of applicants examined 357, as shown in the following table, with percentages:

| Applicants. | Examined. | Registered. | Rejected. | Percentage Rejected. |
|---|---|---|---|---|
| March examination | 39 | 24 | 15 | 38 |
| May examination | 26 | 13 | 13 | 50 |
| July examination | 164 | 139 | 25 | 15 |
| September examination | 57 | 28 | 29 | 50 |
| November examination | 53 | 26 | 27 | 50 |
| Additional special examinations for emergencies | 18 | 17 | 11 | 5 |
| | 357 | 247 | 110 | 41 |

The following tabulation is based upon the results in the first examination of applicants during the year covered by this report:

| Medical institution granting the Degree. | Number Examined | Number Registered. | Year of Graduation of Rejected Applicants. |
|---|---|---|---|
| Tufts | 65 | 62 | 1910—20—22 |
| Harvard | 39 | 39 | |
| Middlesex College of Medicine and Surgery | 35 | 19 | 1920—20—20—20—21—21—21—21—21—22—22—22—22—22—22—22. |
| Boston University | 19 | 19 | |
| St. Louis College of Physicians and Surgeons ... | 15 | 3 | 1918—20—20—21—21—21—22—22—22—22—22—22. |
| Foreign | 13 | 9 | 1912—13—17—19. |
| Massachusetts College of Osteopathy | 13 | 8 | 1919—20—21—22—22. |
| Physicians & Surg., Boston | 9 | 3 | 1912—15—16—20—20—21. |
| Johns Hopkins | 7 | 7 | |
| University of Vermont | 7 | 7 | |
| College of Physicians and Surgeons of Columbia Col. | 5 | 5 | |
| Yale | 5 | 5 | |
| Chicago College of Osteopathy | 5 | 5 | |
| University of Michigan | 3 | 3 | |
| Kansas City University of Physicians and Surgeons | 3 | 2 | 1920. |
| Woman's Medical College of Pennsylvania | 3 | 3 | |
| Hahnemann, Philadelphia | 3 | 3 | |
| McGill | 3 | 2 | 1921. |
| University of Maryland | 2 | 1 | 1921. |
| Cincinnati College of Medicine and Surgery | 2 | 2 | |
| University and Bellevue Hospital | 2 | 2 | |
| Jefferson Medical College | 2 | 2 | |
| Dartmouth Medical College | 2 | 2 | |
| Bowdoin | 2 | 2 | |
| University of Georgetown | 2 | 2 | |
| State Univ. of Iowa | 2 | 2 | |
| University of Denver | 1 | 1 | |
| University Southern California | 1 | 1 | |
| Kentucky School Medicine | 1 | — | 1906. |
| Howard | 1 | 1 | |
| Syracuse University | 1 | 1 | |
| Bellevue Hospital Med. Col. | 1 | 1 | |
| University Georgia | 1 | 1 | |
| University St. Louis | 1 | 1 | |
| American Medical Missionary College | 1 | 1 | |
| Temple University | 1 | 1 | |
| Ohio State University | 1 | 1 | |
| Rush Medical College | 1 | 1 | |
| Washington University, St. Louis | 1 | — | 1919. |
| University West Tennessee | 1 | — | 1914. |
| Laval | 1 | — | 1912. |
| Kansas City University | 1 | — | 1922. |

| Medical Institution Granting the Degree. | Number Examined. | Number Registered. | Year of Graduation of Rejected Applicants. |
|---|---|---|---|
| University of Kansas | 1 | 1 | |
| Physicians and Surgeons of Baltimore | 1 | — | 1918. |
| Chicago Medical School | 1 | 1 | |
| University of Illinois | 1 | 1 | |
| Baltimore Medical College | 1 | 1 | |
| University of Indiana | 1 | 1 | |
| Northwestern University | 1 | 1 | |

Tabulations showing number of first examinations and average rating of applicants from medical schools represented by not less than three applicants follow:

| Medical Institution Granting the Degree. | Number Examined. | Average Rating. | Medical Institution Granting the Degree. | Number Examined. | Average Rating. |
|---|---|---|---|---|---|
| Tufts | 65 | 79.1 | University of Vermont | 7 | 80.2 |
| Harvard | 39 | 84.2 | College of Physicians and Surgeons of Columbia College | 5 | 83.9 |
| Middlesex College of Medicine and Surgery | 35 | 72.9 | Yale | 5 | 81 |
| Boston University | 19 | 81.7 | Chicago College of Osteopathy | 5 | 78.3 |
| St. Louis College of Physicians and Surgeons | 15 | 66.7 | University of Michigan | 3 | 85.7 |
| Foreign | 13 | 70.8 | Kansas City University, Physicians and Surgeons | 3 | 75.5 |
| Massachusetts College of Osteopathy | 13 | 73.5 | Women's Medical, Pennsylvania | 3 | 80 |
| Physicians and Surgeons, Boston | 9 | 69 | Hahnemann, Philadelphia | 3 | 79.1 |
| Johns Hopkins | 7 | 84 | McGill | 3 | 79 |

The following tabulation shows the record of rejected applicants, and the institutions from which they were graduated:

| Name of Institution Granting the Degree. | Number Rejected. | Times Rejected. | Registered on— |
|---|---|---|---|
| Middlesex College of Medicine and Surg. | 1 | 4 | Fifth examination. |
| " | 2 | 4 | |
| " | 1 | 2 | Third examination. |
| " | 6 | 2 | |
| " | 3 | 1 | Second examination. |
| " | 3 | 1 | |
| St. Louis College of Physicians and Surgeons | 2 | 4 | |
| " | 2 | 3 | |
| " | 2 | 2 | |
| " | 2 | 1 | Second examination. |
| " | 4 | 1 | |
| College Physicians and Surgeons, Boston | 1 | 4 | |
| " | 1 | 3 | |
| " | 1 | 2 | Third examination. |
| " | 3 | 2 | |
| Massachusetts College of Osteopathy | 1 | 3 | |
| " | 3 | 2 | |
| " | 1 | 1 | |
| Foreign | 3 | 2 | |
| " | 1 | 1 | |
| Kansas City University Phys. & Surgeons | 1 | 2 | |
| McGill | 1 | 1 | |
| University of Maryland | 1 | 2 | |
| Kentucky School of Medicine | 1 | 2 | |
| Washington University | 1 | 1 | Second examination. |
| University West Tennessee | 1 | 1 | |
| Laval | 1 | 1 | |
| Kansas City University | 1 | 2 | |
| Physicians and Surgeons, Baltimore | 1 | 2 | |

## WEEKLY HEALTH INDEX.

The Department of Commerce, Washington, summarizes the mortality reports from the largest cities of the United States as follows:

Telegraphic returns from 69 cities with a total population of twenty-nine million for the week ending March 31 indicate a mortality rate of 14.5 as against 14.0 for the corresponding week of last year. The highest rate (24.5) appears for Memphis, Tenn., and the lowest (7.5) for Akron, Ohio. The highest infant mortality rate (164) appears for New Bedford, Mass., and the lowest (18) for Cambridge, Mass.

The annual rate for the 64 cities, which have sent in all weekly reports for 1922 and 1923, is 16.2 for the thirteen weeks of 1923, against a rate of 15.2 for the corresponding period of 1922.

## News Items.

NEW HOSPITAL OPENED.—The Leominster Hospital Association opened the new hospital building on North Main street for inspection Saturday and Sunday, April 14 and 15, from 2 to 5 P. M.

JOURNAL OF MEDICAL RESEARCH.—Dr. Frank B. Mallory, director of the laboratory at the Boston City Hospital, and treasurer-elect of the American Association of Pathologists and Bacteriologists, has accepted the editorship of the *Journal of Medical Research*.

CHANGE OF OFFICE.—The Association for the Prevention and Relief of Heart Disease announces the removal of its executive offices on April 1st to Rooms 1641-42, Penn Terminal Building, 370 Seventh Avenue, New York. Telephone, Longacre 2000.

WEEK'S DEATH RATE IN BOSTON.—During the week ending April 11 the number of deaths reported was 254, against 253 last year, with a rate of 17.19. There were 37 deaths under one year of age, against 42 last year. The number of cases of principal reportable diseases were: Diphtheria, 53; scarlet fever, 72; measles, 178; whooping cough, 99; typhoid fever, 1; tuberculosis, 39. Included in the above were the following cases of non-residents: Diphtheria, 10; scarlet fever, 9; measles, 2; tuberculosis, 5. Total deaths from these diseases were: Diphtheria, 1; scarlet fever, 1; measles, 2; whooping cough, 3; tuberculosis, 17. Included in the above were the following cases of non-residents: Tuberculosis, 2.

AMERICAN ASSOCIATION OF PATHOLOGISTS AND BACTERIOLOGISTS.—At the joint convention of the American Association of Pathologists and Bacteriologists, the International Association of Medical Museums and the American Association of Immunologists, at the Evans Memorial on March 30, Dr. Theobald Smith was elected president of the Association of Pathologists and Bacteriologists. The other officers elected were: Dr. James Ewing of New York, professor at Cornell Medical School, vice president; Dr. F. B. Mallory, director of the laboratory at the Boston City Hospital, treasurer; Dr. H. T. Karsner, professor at Western Reserve University, Cleveland, secretary. On the same evening the annual banquet was held at the Algonquin Club, and on the following day the session ended with a luncheon at the Evans Memorial.

### RECENT DEATHS.

ALBERT KIDDER PAGE, a fellow of the Massachusetts Medical Society, formerly a resident of Boston, died at Arlington Heights, April 3, 1923, aged 59.

MISS HANNAH STANGER, 54, who has been the faithful door attendant at the House of Mercy Hospital, Pittsfield, for 30 years, died there April 1, after a three days' illness with pneumonia. She had been associated with the hospital longer than any one else and hundreds of patients and visitors always will remember the cordial greeting they received from "Hannah" as soon as they entered the building. When she first went to work for the hospital it was on the opposite side of North Street and only a small institution compared with what it is today. Miss Stanger was a member of St. Charles Church and active in its societies.

Six physicians who are on the hospital staff acted as bearers at the funeral at St. Charles Church. They were Drs. Henry Colt, John B. Thomes, Thomas Hennelly, Maurice S. Eisner, I. S. F. Dodd and H. J. Downey.

DR. ARTHUR PEDRO PERRY, who died April 1, at his home in Jamaica Plain, was born in Portland, Me., April 5, 1858. He was graduated from the Harvard Medical School in the class of 1886 and until the time of his illness had practised in Jamaica Plain. After a year of study abroad, in 1897 he opened an office in Boston for the treatment of diseases of the skin. He served on the staff of the Boston City Hospital and Boston Dispensary and for a number of years had charge of the Dispensary in Jamaica Plain. He was visiting physician at the Infant Asylum, as well as one of the original staff of the Faulkner Hospital.

He was a member of the Massachusetts Medical Society, and one time president of the Norfolk District Medical Society, and a founder of the Clinical Club. He was a member and past master of the Eliot Lodge of Masons. During the World War Dr. Perry served two and one-half years in the United States Army Medical Corps, receiving his officer's commission in August, 1916, and was a member of the Military Order of Foreign Wars.

He is survived by his widow, formerly Mary Hale Cumings; a son, Roger Adams Perry, and a daughter, Mary Louise Perry. There also are three surviving brothers, Rev. Lawrence Perry of Hingham, Dr. Fred M. Perry of Framingham, and Philip E. Perry of Lexington; and a sister, Miss Mary M. Perry of Jamaica Plain.

## Correspondence.

### BREAST-FEEDING.

*Mr. Editor:*

The Massachusetts Department of Public Health is planning a "Baby's Rights Campaign," to begin May 6. The purpose of this campaign is not only to stress the importance of breast-feeding, but also to broadcast to mothers helpful information to which they might not have had access before.

It might be thought that upon such a subject as breast-feeding the last word had been said and that the practice would be universally insisted upon by all physicians in charge of young infants and, furthermore, willingly adopted by the mothers. It seems to be a fact, however, that breast-feeding is not practised as it should be; and for this state of affairs some responsibility rests with physician and nurse as well as with patient.

This responsibility is a serious one. The death rate among bottle-fed babies is more than five times as great as in the case of breast-fed babies. This being so it is well worth while to make an unusual effort to interest the public in the importance of breast-feeding. Physicians, nurses and health officers must be the ones to do this.

There are various reasons why so many mothers, especially American mothers, do not nurse their babies. These reasons are not always selfish ones, but are sometimes so. The medical evidence seems to show that most of the reasons back of weaning the baby early are not valid. They run the gamut from well-meant advice of relatives or neighbors to selfish indulgence in social pleasures. It would seem that if the mother realized to the full the importance of breast-feeding to her baby she would be slow to run counter to her physician's advice in this regard.

With the help of the pediatricians on its Advisory Committee, the Massachusetts Department of Public Health has prepared a leaflet containing the latest facts on breast-feeding. In addition to this the Department has prepared a popular flyer on breast-feeding which gives concrete suggestions to mothers. This flyer is intended as a sort of reminder which might well be given out from the family physician's office. It emphasizes first, the value of breast-feeding and, second, some remedies for apparent failures.

Any field of activity is sown from the seeds of experience. It is of interest to physicians and nurses to know that in Minneapolis the problem of infant feeding has been so successfully attacked that breast-feeding is said to be almost universal. This standard is possible of attainment, but only with the support of every member of the medical and nursing professions. Such support is confidently looked for.

MERRILL CHAMPION, M.D.
*Director, Division of Hygiene, Massachusetts Department of Public Health.*

## A CORRECTION.

*Dear Mr. Editor:*

The statement in the April 12, 1923, issue of the BOSTON MEDICAL AND SURGICAL JOURNAL that "the Boston Surgical Society will entertain the Tri-State Medical Society (Iowa, Illinois and Wisconsin)" is sufficiently incorrect to give a false impression. The Tri-State Society, on the afternoons of April 17 and 18, will be the guest of the Harvard Medical School, where a scientific program is to be presented. In the forenoons of these days the society will be the guest of Boston hospitals, where demonstrations will be given. On the evening of April 17 the Tri-State Society members will be guests at dinner at the Harvard Club, at which the members of the Boston Surgical Society and a group of 27 internists (physicians and pediatricians) will be the hosts. Arrangements have been made for the visit by a committee composed of officers of the Boston Surgical Society and the honorary members of the Tri-State Medical Society resident in Boston. So it is apparent that the Boston Surgical Society is only in part the host to these visiting medical men from Iowa, Illinois and Wisconsin.

HENRY A. CHRISTIAN.

## NOTICES.

### SUFFOLK DISTRICT MEDICAL SOCIETY.

ANNUAL MEETING, APRIL 25, 1923.

BOSTON MEDICAL LIBRARY, 8.15 P. M.

Business: Election of Officers.
Subject of the evening: "The Treatment of Syphilis, Past, Present and Future."
Introduction. Dr. Abner Post.
"Prenatal and Early Congenital Syphilis," Dr. Karlton G. Percy.
"Early Acquired Syphilis," Dr. Henry J. Perry.
"Visceral and Vascular Syphilis," Dr. William D. Smith.
"Neurosyphilis." Dr. Harry C. Solomon.
"Medico-legal Aspects." Dr. Timothy Leary.

The discussion will be opened by Drs. Philip Sylvester, William H. Watters and James B. Ayer.

Refreshments after the meeting.

RICHARD H. MILLER, M.D.,
*Secretary.*

JAMES S. STONE, M.D.,
*President.*

### WALTER REED GENERAL HOSPITAL.

WASHINGTON, D. C.

The next course of instruction in Physio Therapy will be given at Walter Reed General Hospital, Washington, D. C., beginning Oct. 5, 1923, and continuing for a period of four months. It is open to women who have had at least two years of training in an approved school of Physical Education. For further information, apply to The Commanding Officer, Walter Reed General Hospital, Washington, D. C., Att. Department of Physio Therapy.

JAMES B. MONTGOMERY,
*Major, M. C., U. S. Army.*
*Director of Physio Therapy.*

## UPLAND TRAILS.

In the land of the lotus the scent-laden air
Lulls the drowsy to slumber and freedom from care,
For the branches hang low with accessible fruit,
And the wakening trumpet hangs idle and mute.

In the land of the lotus the creepers have grown
In the paths that the feet of the eager have known,
And the mountains cast shadows that linger below,
But their trails are unbroken and drifted with snow.

In the land of the lotus the mighty have ceased
From their labors and pleasantly sit at the feast,
For the way is neglected that leads to the peak,
And the call to achievement is empty and weak.

No goals are contested, no races are run;
No visions are seen and no prizes are won;
No souls are exalted, no causes retrieved—
In the land of the lotus no heights are achieved.

Let the eaters of lotus still lie at their ease;
Let them fatten on sloth and the viands that please,
But the trails of the uplands are open to you,
And the heights may hold wonders the plains never knew.

JOG.

## CASES REPORTED TO THE MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH.

WEEK ENDING MARCH 31, 1923.

| *Disease.* | *No. of Cases.* | *Disease.* | *No. of Cases.* |
|---|---|---|---|
| Anterior poliomyelitis | 1 | Ophthalmia neonatorum | 16 |
| Chicken-pox | 102 | Pneumonia, lobar | 103 |
| Diphtheria | 182 | Scarlet fever | 340 |
| Dog-bite requiring anti-rabic treatment | 2 | Septic sore throat | 5 |
| Encephalitis lethargica | 12 | Suppurative conjunctivitis | 11 |
| Epidemic cerebro-spinal meningitis | 5 | Syphilis | 33 |
| German measles | 13 | Trachoma | 1 |
| Gonorrhea | 103 | Tuberculosis, pulmonary | 119 |
| Influenza | 40 | Tuberculosis, other forms | 13 |
| Measles | 763 | Typhoid fever | 15 |
| Mumps | 282 | Whooping-cough | 382 |

## SCHICK TOXIN-ANTITOXIN ACTIVITIES OF BOSTON HEALTH DEPARTMENT.

MAY 6, 1922, TO APRIL 6, 1923.

| Schick Tests | Readings | Positive | Positive Combined | Pseudo | Negative | T. A. T. Injections 1st | 2nd | 3rd |
|---|---|---|---|---|---|---|---|---|
| | | | | COMPLETED CASES. | | | | |
| 30,038 | 27,959 | 12,564 | 1,591 | 4,079 | 9,725 | 12,856 | 11,604 | 10,777 |
| | | | | RE-SCHICKS. | | | | |
| 2,786 | 2,567 | 260 | 31 | 487 | 1,789 | 191 | 122 | 104 |
| | | | | PRE-SCHOOL AGE. | | 237 | 217 | 201 |
| | | | | GRAND TOTAL. | | | | |
| 32,824 | 30,526 | 12,824 | 1,622 | 4,566 | 11,514 | 13,284 | 11,943 | 11,082 |

General immunity produced on re-Schicking to date—88.6%

A group of 1,808 children recently re-Schicked shows the following percentage of immunity produced after first, second, and third injections of Toxin-Antitoxin:

Immunity produced after 1 injection of T. A. T.—45%
Immunity produced after 2 injections of T. A. T.—77.7%
Immunity produced after 3 injections of T. A. T.—94.7%

CULTURES.

Cultures of Positive Schick Reactors before T. A. T.

| Number | Positive | Negative | Percentage |
|---|---|---|---|
| 1,663 | 103 | 1,560 | 6.5% Positive |

Cultures of Negative Schick Reactors

| | | | |
|---|---|---|---|
| 1,000 | 57 | 943 | 5.7% Positive |

Cultures of Positive Schick Reactors 6 months after T. A. T.

| | | | |
|---|---|---|---|
| 1,347 | 36 | 1,311 | 2.7% Positive |
| 4,010 | 196 | 3,814 | 4.96% Positive |

Diphtheria cases investigated from December 1, 1922, to date—1,029.

JOHN A. CECONI, *Epidemiologist.*

### SOCIETY MEETINGS.

The annual meeting of the Massachusetts Medical Society will be held in Pittsfield, June 12 and 13.

DISTRICT SOCIETIES.

A list of society meetings is herewith published. This list will be changed on information furnished by the secretaries of the societies, and will appear in each issue.

Barnstable District:—Hyannis, May 5, 1923.

Bristol North District:—Annual Meeting at Taunton, April 26.

Bristol South District:—Fall River, May 3, 1923.

Essex North District:—Lawrence, Y. M. C. A. Building (Annual Meeting), May 9, 1923.

Meetings of the Suffolk District and the Boston Medical Library, at the Library:

April 25, 1923:—Annual Meeting. Election of Officers. "The Record of the Past Twelve Years in Syphilology, with a Forecast of the Future." A series of 10-minute papers. Dr. C. Morton Smith, Boston, will preside.

Middlesex East District:

May 9, 1923:—Annual Meeting.

All meetings except the Annual Meeting will be held at the Harvard Club in Boston. A. E. Small, Secretary.

Worcester District meetings are scheduled as follows:

May 9, 1923:—Annual Meeting and banquet.

STATE, INTERSTATE AND NATIONAL SOCIETIES.

NEW ENGLAND PEDIATRIC SOCIETY:—The following are the dates for meetings the coming season. Each meeting is on the second Friday of the month at the Boston Medical Library: April 13 and May 11.

April, 1923:—Massachusetts Association of Boards of Health, April 26, 1923, Boston; W. H. Allen, Mansfield, Mass., Secretary.

April, 1923:—Massachusetts Public Health Conference will be held in Springfield, April 26-28, inclusive. Dr. Eugene R. Kelley, Chairman.

May, 1923:—Massachusetts Society of Examining Physicians (date and place undecided). American Pediatric Society meeting, May, 31, June 1 and 2, 1923, at French Lick Springs Hotel, French Lick, Ind.; H. C. Carpenter, Secretary.

May, 1923:—Boston Association of Cardiac Clinics. Meeting May 17, 1923, at 8.15 P. M., Children's Hospital. Subject: Rheumatism and Chorea and Heart Disease.

June, 1923:—The Nineteenth Annual Meeting of the National Tuberculosis Association will be held in 1923 in Santa Barbara, Calif., from June 20 to 23, inclusive, in the Recreation Center.

June, 1923:—American Medical Association, San Francisco, June 25-29, 1923; Olin West, Chicago, Ill., Secretary.

July, 1923:—Massachusetts Association of Boards of Health, July 26, Nantasket; W. H. Allen, Mansfield, Mass., Secretary.

October, 1923:—Boston Health Show will be held in Boston, October 6-13, inclusive.

October, 1923:—Meeting of the American Health Association will be held in Boston, October 8-13, inclusive.

### BACK NUMBERS WANTED.

For copies of the JOURNAL of January 4, 1923, January 11, 1923, and February 22, 1923, this office will pay twenty cents per copy; for the JOURNAL of May 6, 1921, twenty-five cents per copy. Mail to the BOSTON MEDICAL AND SURGICAL JOURNAL, 126 Massachusetts Avenue, Boston, Mass.